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ABSTRACT

The report describes the features, underlying knowledge base, and goals of the "Smart Needs Assessment Program" (SNAP), an interactive, microcomputer-based system designed to provide inservice training in special education for regular education teachers. The Teacher Effectiveness Expert System portion uses teacher data concerning attitudes, goals, and background to identify teaching problems with direct instruction, questioning skills, or academic learning time. Finally, the teacher works with the Training Experience Selecting Expert System which uses some 200 options to produce an individualized set of recommended training experiences based on the data entered earlier as well as on responses to additional questions eliciting information on student age, teaching area, availability of teachers' aides, and other factors. An evaluation of the system conducted with 18 teachers suggested that it improved attitudes toward mainstreaming and increased concerns about impact upon students, collaboration with other professionals and widening the benefits of mainstreaming. A study comparing the system's training recommendations with those made by expert trainers found the SNAP system comparable. Fourteen appendixes comprising 90 percent of the document provide technical background on the system, samples of questionnaires and forms, discussions about the design and use of expert systems, and a 50-page bibliographic chart analyzing research on effective instruction. (VW)

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FINAL PROJECT REPORT

HPP SPECIAL PROJECT

Microcomputer-Assisted Needs Assessment System for Teacher Training in Special Education

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NEEDS ADDRESSED BY THE SNAP PROJECT

The Special Project to develop and test our microcomputer-based needs assessment and training system for teacher training in special education was begun in 1983. This system is now called "SNAP" (for Smart Needs Assessment Program). Information about the development of the system has been included in our continuation proposals, and a complete description of the SNAP System is presented in the PRODUCTS section of this report.

In this section, we discuss the needs that were addressed in the SNAP Project. This section is partially based on the arguments in our original application, but also includes more recent data on training needs and information collected during the course of the project. Appendix A contains a technical report which we have disseminated with a more detailed explication of the original project rationale.

The Personnel Training Needs Addressed

Numbers of Teachers Needing Training

The placement of special education students in regular classrooms continues to put a burden upon regular educators, many of whom lack the willingness, confidence and/or training to work with these students. As a result, inservice training of regular education teachers has been recognized as a critical need in special education. The extent of this need is documented by a recent nationwide survey on personnel training in special education (McLaughlin, Smith-Davis & Burke, 1986). This survey found that inservice training of regular educators was the most frequently identified high priority training need (identifed by 86% of the states and jurisdictions).

In the State of Maryland, this training need has been recognized for several years and is addressed by a statewide certification requirement that all regular educators obtain 3 credits of training in special education. In a survey on inservice training needs involving 2,500 regular educators in the state, our Institute found that over 30% of the respondents did not have any training in special education (Noel, Malouf & Fitzmartin, 1983). If this percentage can be applied to the 44,000 statewide population of regular educators, then over 13,000 teachers in Maryland need inservice training to acquire an initial exposure to special education and meet the certification requirement. Moreover, when asked if they would like additional training in areas related to special education, over 60% of the respondents answered "yes". Applying this percentage to the 44,000 population yields over 26,000 teachers in Maryland who desire additional training. Not surprisingly, in the CSPD component of the State Plan for Special Education, the Maryland State Department of Education has identified "training for general education personnel programming for handicapped students in regular programs" as one of six training priorities.

What These Teachers Need to Learn

Inservice training for regular educators should address three domains: knowledge, skills and attitudes. This section contains a discussion of the knowledge and skill domains followed by a discussion of the attitude domain.

Training needs in the knowledge and skill domains. In the aforementioned survey of 2,500 teachers in Maryland (Noel et al., 1983), we found that teachers rated a broad range of competencies in both knowledge and skill domains as important. In the knowledge domain, particularly high importance ratings were given to knowledge of the federal and state laws, roles of various educational personnel involved in educating handicapped students, and characteristics of learning disabilities. In the skill domain, particularly high ratings were given to skills in identifying handicapping conditions vs cultural or linguistic differences, conducting individual assessments, communicating assessment results, providing for positive social interactions between handicapped and nonhandicapped students, using on-going assessment to monitor progress, and identifying school and nonschool resources for handicapped students.

Further evidence of the diversity of knowledge and skill needs comes from our experience with the SNAP System project during the last three years. For example, one feature of the SNAP System is a goal setting program (see Appendix B) where the teachers select up to five goals for themselves from a list of 23. In our most recent field test involving 25 teachers, we found that all but one of the goals were selected by at least one teacher. The most frequently selected goals were: To learn more about (1) how to select and adapt materials (64%), (2) how to teach students who are having trouble learning (60%), (3) how to provide instruction for slower students without disrupting instruction for other students (60%), (4) how to deal with student behavioral or motivational problems (48%), (5) approaches to working with special education students (40%), (6) the learning problems students can have in school (32%), (7) the behavioral and motivational problems that students can have in school (24%), (8) how to analyze student learning problems (20%), (9) how to encourage desirable social interactions (20%), (10) how to gain access to instructional materials and equipment (16%), and (11) how to work with other educators on tasks related to mainstreaming (16%). These goals represent both knowledge and skill domains.

Another aspect of the SNAP System is a series of self observations completed by teachers in their own classrooms (see Appendix C). Data from these self observations are analyzed to indicate training needs related to teacher effectiveness. In our most recent field test, 18 teachers completed these observations on direct instruction, questioning skill, and academic learning time. The group viewed as a whole was not seen to have major weaknesses in any of the areas. In only one category--students' success in answering questions--was the percent of need for training as high as 50%. The following chart displays the areas of weakness and the percent of teachers who were identified by SNAP as needing training in these areas.

Direct Instruction	
amount was too high	6%
amount was too low	11%
Questioning Skill	

opportunities to respond were too few	33%
success level was too low	50%
response distribution was uneven	44%

Academic Learning Time

engaged time was too low	22%
success level was too low	22%
allocated time was too low	0%

While teaching skills should be included in the inservice training of regular educators about mainstreaming, these data suggest that the specific skills to be developed should be clearly differentiated.

Training needs in the attitude domain. It is generally accepted that inservice training for regular educators must address attitudes, but that attitudes may be difficult to define, evaluate and change (Larrivee & Cook, 1979; Boyle & Sleeter, 1981; Powers, 1983; Burrello & Orbaugh, 1982). In our research, we have found ample evidence of the need to change teacher attitudes and opinions. In the aforementioned survey of 2,500 teachers in Maryland (Noel et al., 1983), the respondents were given an opportunity to make comments, and one-third of them did. A content analysis of these comments found that the most frequent topic area was concerns about mainstreaming, and the most frequent subtopic within this area was concerns about the burden to the teacher, although concerns about the impact on regular students and special education students were also expressed.

The SNAP System includes a 6-item measure of attitudes or opinions related to mainstreaming. In the development and validation of this Attitudes Toward Mainstreaming instrument, we administered the items to 53 regular teachers. An average of 31.5% of the responses across the six items were in the negative range. For example, 19% of the teachers disagreed with the statement that special education students have the ability to participate appropriately in regular classes, 21% agreed that the behavior of mainstreamed students too often sets a bad example for regular students, and 66% disagreed that regular educators generally possessed the expertise for effectively teaching mainstreamed students.

Another component of the SNAP System is a version of the Stages of Concern Instrument (Hall & Loucks, 1978), which was adapted to measure concerns about mainstreaming. We administered this instrument to a sample of 98 teachers and found that 21% had information concerns, 4% had personal concerns, 7% had management concerns, 23% had consequence concerns, 20% had collaboration concerns, and 3% had refocusing concerns.

Summary of The Personnel Training Needs Addressed by the SNAP System:

1. A large number of regular educators need training in working with mainstreamed special education students. This need exists nationally as well as in Maryland and includes teachers who need to acquire an initial exposure as well as teachers who have had such an exposure and desire additional training.

2. A broad range of training needs in the domains of knowledge, skills and attitudes are present among the population of regular educators. An examination of the specific training needs in the previous discussion underscores this conclusion. A comprehensive approach to inservice training should be capable of addressing needs in all of these areas.

3. Teachers differ widely with regard to training needs, and no single training need is predominant. Among the percentages of specific training needs in the preceding discussion, very few exceed 50%. Inservice training which provides "blanket" training experiences to all of the trainees is likely to miss a lot of individual training needs and to provide training in unnecessary areas for the individual trainees. True individualization of inservice training requires that specific training needs be addressed which occur in a small segment of the population.

The Needs for Improved Approaches

The SNAP System was designed to remedy certain flaws in current approaches to needs assessment and teacher training. These are discussed below.

The Need for Better Needs Assessment Strategies

At the heart of any inservice training program is a process for determining what training experiences the trainees will receive. This process of needs assessment is generally a weak link in the process.

Scriven and Roth (1978) stated the case quite strongly.

> Needs assessments have been for some time the most ludicrous spectacle in evaluation. The usual "models" are farcical and decisions based on them are built on soluble sand. (p. 25)

The need to base training decisions on better data. In current practice, if inservice training experiences are adapted to trainee needs at all, they are primarily selected on the basis of trainee self reports which are conducted by means of written questionnaires or (less frequently) interviews. Such methods are subject to the following criticisms:

A. Trainees tend to confuse "wants" with "needs," or "perceived needs" with "real needs" (Kuh, et al., 1980; Mann, 1980). For example, a teacher may want to know the procedures for referring a student for placement in special education, when the teacher actually needs to know teaching strategies for accommodating exceptional students in his/her classroom. The need may not be expressed simply because the teacher is unaware of it.

B. Teacher self-reports may be unreliable or inaccurate (Hook & Rosenshine, 1979).

C. Other types and sources of information (such as environmental factors and teacher performance observations) are rarely utilized, although they are often instrumental in determining the effectiveness of inservice training.

The need for linking needs assessment with training. An additional weakness in current inservice training practices relates to the use of needs assessment data in making training decisions. Smith and Siantz (1978) referred to this weakness in a summary of information collected from public school personnel:

> In the process of inservice training, a strategic point is obviously the selection of the specific program, process, or product that is to be the vehicle for training. For each of the countless potential areas in which training may be needed, a multiplicity of packages has been developed... The problem, as some of these people see it, is that information has proliferated to the extent that it is becoming unmanageable...The selection process that should lead to a good match between user and resource becomes snarled because of the difficulty in sorting it all out and determining which programs will in fact work with specific populations...(p 247)

The Need for Better Inservice Training

Teachers often complain that inservice training experiences are irrelevant or ineffective. In recent years, the importance of inservice training has been increasingly recognized, and a number of principles have been developed for effective inservice training. Below are described some major principles which are based upon research and practice in inservice training (Hutson, 1981; Burrello & Orbaugh, 1982; Powers, 1983; Joyce and Showers, 1980; Boyle & Sleeter, 1981), as well as general literature on adult learning (Banks, 1981).

1. Teachers should recognize the direct relevance of training. Training should be tailored to the individual needs of teachers, and to the degree possible, training should be self directed and problem oriented. Teachers

should be actively involved in the process of needs assessment and should see how their training experiences are derived from analyses of their needs. The process of needs assessment itself should be a learning experience.

2. Training should be both broad based and focused. It should be responsive to a broad range of needs in knowledge, skill and attitude domains while at the same time it is focused on specific content needs. In addition, it should be differentiated according to stage of learning (from awareness through application) and type of learning (refining old skills, learning new skills, learning new knowledge, changing attitudes, etc.).

3. Training should draw upon the full range of resources and methods available. In addition to commercially available products, a number of innovative and effective resources and methods continue to be developed, including teacher facilitators, simulations, etc. A system for inservice training should readily incorporate new training resources and methods.

PRODUCTS AND ACTIVITIES

The SNAP System uses four measurement instruments, a knowledge base of training options, and two expert systems as displayed in Figure 1. In the following section, we discuss these products and the development and evaluation activities related to them.

Measurement Instruments

1. Descriptive Survey and Attitudes Toward Mainstreaming Scale (see Appendix D): This computer program is linked with the Stages of Concern Survey and both are usually completed in one session at the computer. The information collected by the Descriptive Survey serves two functions. Primarily, it is used to determine decision factors such as teaching level and teaching area. Also, it was used in our evaluation activities to obtain data on trainees.

The Attitudes Toward Mainstreaming Scale is a six-item scale designed to provide a measure of the teacher's attitude toward handicapped students and mainstreaming. The items were selected from a larger set of items on the basis of a field test with 53 regular education teachers. Appendix D describes the development of this scale.

2. Stages of Concern (SOC) Survey (see Appendix E): This is a computer program that delivers and interprets our revision of the Stages of Concern questionnaire developed by Gene Hall and his colleagues. Our revision was designed facilitate its use in the SNAP System. The process of adapting, testing and final revision is described in our Technical Report #201 (Appendix F).

Because of concerns about the scoring and interpretation of the SOC instrument, we developed an algorithm for identifying subscales which could be considered as high or low enough to have training implications. Briefly, this algorithm calculates the overall mean and standard deviation of the 30 items on the revised SoC instrument, and the mean and standard error of each of the 6 subscales (5 items each). It then identifies "outliers" -- scales for which the mean is more than one standard error away from the overall mean plus or minus the overall standard deviation. The development of this algorithm is described in our Technical Report #203 (see Appendix G). The algorithm performs its calculations immediately after the teacher completes the survey, and it presents the results to the teacher in a graphic profile. The outliers are then stored on the computer disk for later use in selecting training experiences. This approach to analyzing the SOC has two major advantages--it produces data that can readily be used by the computer, and it provides a more accurate analysis of the SOC profile than can be accomplished by visual inspection.

3. Goal Setting Program (see Appendix B): This computer program presents the teacher with 23 possible learning goals and allows him/her to select up to 5. The teacher can change the selection at any time. The program is designed to allow easy modification of the list of available goals. An initial test of this survey is described in Appendix H. In our final field test, 25 teachers completed this Goal Setting Program, and all but one of the 23 available goals were selected at least once. The selected goals are included in the set of training needs covered by the SNAP System. Our inclusion of this program reflects our belief that inservice teacher training should be driven, at least in part, by the learning goals of the teachers themselves.

4. Classroom Observations (see Appendix C): These observations are conducted by the teacher in his/her own classroom, then the data are entered into the computer by means of a computer program which queries the teacher for specific items of information. These observations focus on the teacher's use of instructional time and the teacher's questioning methods and the amount of success experienced by the students. These specific areas were selected after our extensive review and analysis of research on teacher effectiveness; we consider them to be critical areas for assessment and training.

Summary of the Technical Operation of the SNAP System

Before proceding to the description of the training approaches used in the SNAP System, a summary of the technical operation of the needs assessment process might be helpful. The trainee begins his/her experience with the SNAP System by completing the Descriptive Survey and the Attitudes Toward Mainstreaming Scale, the Stages of Concern Survey and the Goal Setting Program. This is frequently but not always done in one session at the computer. The trainee has a computer diskette which stores the results of his/her interactions with the computer.

Following this, the trainee completes his/her self observations, which may take approximately three weeks. The trainee interacts with the computer to enter the data from each observation. This is the Teacher Effectiveness Expert System. This system interprets the self observation data according to the rules in the knowledge base, and determines if the teacher has problems related to the three areas of teacher effectiveness previously described. The results of this interaction are stored on the trainee's diskette.

The final interaction with the computer involves the Training Experience Selecting Expert System. This system starts with the data on the student's diskette and selects various combinations of training experiences which meet all of the training needs presented. It then asks questions to narrow down these alternatives. For example, it may ask if the person has a teacher's aide, and if the person does not, eliminate any training alternatives which require an aide. It may ask about prerequisite knowledge. It may ask for more specific information about problems that the teacher wishes to learn about. All of these questions are generated by the codes associated with the sets of training options the system is considering. Thus, whenever we code and add a new training option to the data base, the system automatically begins to ask the questions needed to select or eliminate that option. It also tries to make its selections with the fewest possible questions. The final product of all of this is an individualized set of recommended training experiences for the trainee. These experiences meet as many needs as possible while being consistent with such decision factors as student age, teaching area, etc. These recommended training experiences form the basis of the SNAP System inservice training.

Figure 1

SNAP System

```
MEASUREMENT                        EXPERT                   TRAINING NEEDS
INSTRUMENTS                        SYSTEMS                   AND DECISION
                                                             FACTORS

Descriptive Survey        -----                  ---------> Teaching Level
and Attitudes             -----                  ---------> Teaching Area
Toward Mainstreaming                             \
Scale                                             >-------> Affective Mode
                                                 /
Stages of Concern Survey -----                   ---------> Stage of
                                                              Concern


Goal Setting Program      -----                  ---------> Goals


Classroom Observations
          |
          |--------------- Teacher Effectiveness-------> Questioning
                                                              Problems
                           Expert System         -------> Academic
                                                              Learning
                                                              Time Problems
                                                 -------> Direct
                                                              Instruction
                                                              Problems
                                                  /
                                                /
                                              /
                                            /
                                          /
                                        /
                                      /

                           Training Experience

          Knowledge Base   Selecting                   ---> Situational
                                                              Requirements
          of Training <---> Expert System              ---> Prerequisites
                                   |
          Options                  |
                                   |
          (currently               |
           approx. 200)           \|/
                          Training Options
                         Selected to Address
                        Training Needs in the
                         Most Efficient Way
```

Knowledge Base of Training Options

Approximately 200 training options comprise the current training options database (Appendix I). Each training option is coded according the the factors considered by the SNAP System in selecting training experiences. The database is easily altered to add, delete, or replace training options. Activities from which teachers can improve their abilities to teach in mainstreamed classes are vast in number and variety. Prior to the teaching of new SNAP courses, the database will be adapted to the needs of the participating school districts. Types of training in the SNAP database will remain extremely diverse.

SNAP training options appear in a great variety of formats, including (1) print media (e.g., books, articles, course handouts, chapters from books, modules, pamphlets), (2) non-print media (e.g., films, videotapes), and (3) activity-based experiences (e.g., meetings with other educators, collaboration with other teachers in school, videotaping for self-observation, case study, tutoring a handicapped child, meetings with handicapped adults).

Categories of Training Experiences

In the following section, we discuss and give examples of training options in our current data base as related to the domains of training, Stages of Concern, and self-selected goals. As indicated in Figure 1, the SNAP System reviews the affective needs, Stage of Concern, self-selected goals, questioning problems, academic learning time problems, direct instruction problems and other decision factors and selects training options from the data base which meet the needs in the most efficient way.

Training Options for Specific Domains:

Knowledge: Informational training options address many areas related to mainstreaming, such as federal and state law, IEP's, characteristics of specific handicaps, special education procedures within school or school system. These options are most frequently written materials obtained from books and journals, although other formats are included.

Skill: Numerous training options teach strategies that teachers can use in mainstreamed classes. Procedures are both generic (e.g., Grouping and Special Needs Students) and specific to a grade level or subject area. Many skill level training options teach strategies that give rationales and step-by-step procedures so that teachers can prepare their own lessons for implementation. Some of the teaching strategies are methods by which teachers can assist all the class, special education and regular students alike, in becoming more competent learners. An example is Author's Chair/Peer Conferencing, which is a language arts strategy. Other teaching strategies are intended to help the classroom teacher provide appropriate instruction to special needs students. An example is Tape Recording Educational Materials for Secondary Handicapped Students. Some training materials are intended to help teachers manage their classrooms more successfully, such as the texts on managing the elementary/ secondasy classrooms effectively. Some training is designed to assist the teacher in managing mainstreaming, such as "Don't

Drown in the Mainstream" published by Kids Come in Special Flavors.

Attitide: Some of the training options are intended to improve teachers' attitudes toward mainstreaming and special needs students. The attitude training options include films, such as "David" and "A Different Approach". Videotapes include "Like Other People" about the feelings of people with cerebral palsy and "Kevin", a narrative about blindness spoken by a blind child. Some training activities bring teachers together with one another so that those with positive attitudes may influence those with less than positive attitudes. Some activities bring teachers into contact with children or adults with handicaps.

Training Options for Specific High Level Stages of Concern Regarding Mainstreaming:

Consequences: Teachers at this stage of concern care about the successful integration of special education students in their regular classes. Training options which pertain to this concern include materials on peer tutoring and within class grouping. Materials on cooperative learning techniques also relate to this concern.

Collaboration: Teachers at this stage of concern care about effective collaboration with their colleagues. Training options appropriate to this concern include recommendations with guidelines for meetings with special educators and for peer observation.

Refocusing: Teachers at this stage of concern are interested in adapting innovations and may be interested in reaching beyond their own school for other ways of making mainstreaming work. To meet this stage of concern numerous organizations and resources are included in the training options database. These include the Council for Exceptional Children, the Spina Bifida Association of America, the American Foundation for the Blind, and curriculum development personnel at the University of Maryland who can assist teachers in developing new curricula.

Training Options for Specific Self-Selected Goals:

All 23 Learning Goals in SNAP have multiple training options associated with them. Below are examples that illustrate sample goals with appropriate training activities:

Goal: I would like to learn more about how to select and adapt materials to teach students who have trouble learning.

Activity: Read article which tells about tape recording educational materials for secondary handicapped students

Goal: I would like to learn more about the learning problems that students can have in school

Activity: Study handout which (1) lists types of difficulties learning disabled students often have in school, (2) tells situations in which the difficulties are likely to occur, and (3) suggests adjustments teachers can make.

Practical and theoretical concerns. It is generally known that teachers benefit from information which is based on research and theory but is translated into a format that is ready for practical application (Waxman, 1985). SNAP training options are generally at the practical level, so that they will be found useful by teachers. However, a small number of training options are more research- or theory-based to appeal to certain teachers to whom these perspectives are of interest.

Grade level and subject matter relevance. Many training options are appropriate for all teachers regardless of the grade or subject they teach. However, many training options are appropriate only for specific grade levels (e.g., Life-Size Learning Games for primary teachers) or for specific subjects (e.g., Science and Life for science teachers). Training recommendations work in such a way that teachers receive training which is appropriate both to their generic and their specific needs. For example, a teacher requesting assistance in conferring with parents will be assigned a training option about meeting with parents, a generic training option appropriate to a specific goal. If the teacher also wants training that is useful for teaching high school science, the teacher will be assigned a training option called Science and Life that is only appropriate for high school science.

Training Formats

The SNAP System is intended for use in a variety of contexts, including workshops, inservices, and school-based teacher assistance teams. In all cases, the training content is highly individualized. When the system is part of group training, the inservice trainers are challenged to integrate the training recommendations for individuals into meaningful training for the group as a whole. As a final field test of the SNAP System, an inservice course was delivered to a group of 18 teachers in a school system. This field test is described in the section on EVALUATION.

The Two Expert Systems

The SNAP System uses two expert systems to answer the questions: (1) What training does the teacher need? (2) What training options are available to meet these training needs? The first question is answered through the diagnostic components of the System (see Measurement Instruments above), including the Teacher Effectiveness Expert System. The second question is answered through the prescriptive component of the system, which is the Training Experience Selecting Expert System.

These two systems are technically very different from one another. They differ in the form and substance of their knowledge bases and in their inference mechanisms. Their technical differences and the rationale for using the two types of expert systems are explained in Appendix J. This section discusses each of these expert systems at a practical level.

The Teacher Effectiveness Expert System

One of the measurement approaches for identifying a teacher's training needs is classroom self observation. As previously discussed, the teacher collects self observation data over a three week period and then inputs the data when queried by the computer. For this data to be used by the SNAP System, it must be interpreted. The Teacher Effectiveness Expert System interprets this data by comparing it to sets of rules about effective teaching. This expert system evaluates a teacher's effectiveness in the areas of assuring an adequate amount of academic learning time (ALT), providing the appropriate amount of direct instruction (DIR), and providing all students with adequate opportunities to respond to questions successfully (QUES).

Rules in the Teacher Effectiveness Expert System (Appendix K) were developed through a complex process. Initially, the broad area of effective teaching was broken down into six categories--instructional approaches, time factors, teacher planning, affective factors, teachers' knowledge and training, and diagnostic-prescriptive teaching. Next, literature in these areas was reviewed and variables relevant to rules production were charted (Appendix L). From these charts, the basic set of rules was written. Next, the basic set was expanded, as described below, to cover all relevant classroom variables. The rules are in three categories--Academic Learning Time (ALT), Direct Instruction (DIR), and Questioning Skill (QUES)--to correspond with the three major areas of effective teaching as delineated in the SNAP project.

Figure 2 is an example of an Academic Learning Time rule drawn directly from research. (Rosenshine found high Academic Learning Time in average second grade reading, language arts, and mathematics classes which had high student engagement rates.) As illustrated in this figure, rules in this expert system include numerous classroom variables.

Figure 2

```
If grade = 2
and teaching area = reading
or teaching area  = language arts
or teaching area  = mathematics
and students' achievement level = average
and students' engagement time   = high
then
Academic Learning Time = HIGH <1.0>
```

Reference: Rosenshine, 1980

Through our analysis of the research on effective teaching we observed that some classroom variables have been studied more comprehensively than others. When we discovered classroom variables not covered by research, we derived rules through extrapolation, i.e., we inferred rules from rules already drawn directly from research. For example, we found research findings regarding second and fifth graders of average achievement that were sufficient for Academic Learning Time rules production, but we had to infer rules to cover third and fourth graders of high and low achievement levels.

Our expert system uses "certainty factors" to indicate the level of confidence we have in our rules. If a rule was drawn directly from research, as in the case of the rule in Figure 2, then a certainty factor of <1.0> was used. If, on the other hand, a rule required that inferences be drawn from other rules, the certainty factor was dropped to reflect the amount of inference. A certainty factor of <0.9> indicates that an inference was drawn regarding one variable in the rule. A certainty factor of <0.8> indicates that inferences were drawn regarding two variables in the rule, and so on.

Teachers interacting with the expert system first input their classroom self observation data then provide responses that are necessary for the system to evaluate their data. When the system has learned enough about a teacher's style, it invokes sufficient rules to cover all the variables. The teacher then is given an evaluation, such as "Academic Learning Time is medium <0.8>." To enhance this brief feedback the system also delivers a message, such as: "Although your students appear to be engaged in learning tasks at a high rate, the amount of time available for instruction seems to be somewhat shorter than it should be. Perhaps you could arrange the schedule for your students so that they have more time in class for learning." Additionally, the teacher can request the system to display the rule or rules that were invoked. Teachers, therefore, who use the Teacher Effectiveness Expert System, may observe the process by which decisions about their self observations are made.

In addition to providing teachers with immediate feedback, the system assesses teachers' data to determine the presence of certain training needs. Identified needs in the areas of Academic Learning Time, Direct Instruction, and Questioning Skill are added to the teacher's needs assessment profile. The second expert system, the Training Experience Selecting Expert System, recommends specific training activities for each area of identified need.

Training Experience Selecting Expert System

The second expert system in the SNAP System is known as the Training Experience Selecting Expert System. Unlike the rule-based system previously discussed, this system consists of frames rather than rules. Each frame is a description of a training option. The expert system contains approximately 200 training options at present. In this frame-based approach, a "hypothesize and test" mechanism operates to find the smallest set of training experiences that addresses the largest set of training needs. Simply put, this expert system considers the training needs of the teacher and all available training options, then it recommends specific training activities which cover all of the needs. This approach is discussed in detail in Appendix J.

Figure 3 is an example of a frame in the Training Experience Selecting Expert System. A frame consists of codes which make the training option specific to certain training needs. Other information about the training option which would be of interest to teachers, such as a training option summary, is not included in the frame but may become conveniently available to teachers. Frames are never visible to teachers using the SNAP System.

Figure 3

Frame Describing Training Option 93

```
Tropt 93:  Tape Recording Educational Materials for Secondary
           Handicapped Students
           SOC     = management,
           GOAL    = improving classroom adaptability OR
                     using media to educational advantage
                     in the classroom,
           ALTprob = engaged time OR
                     success level,
           TLEV    = junior high OR
                     senior high
           SHAPE   = article  .
```

TROPT = training option
SOC = stage of concern about mainstreaming (management indicates concerns related to classroom management)
GOAL = the teacher's professional development goal
TLEV = teaching level
SHAPE = the format of the training option

The process of preparing frames to add to this expert system was really a process of collecting training options and coding them in the training options knowledge base. The collecting process is described below. Coding of training options is explained in the Training Options Coding Manual (Appendix M). Training options themselves are in Appendix I.

The Collecting of Training Options. Interviews with special educators and media specialists guided the initial search for useful training options. Training options were then collected in the broad categories of attitude, knowledge, and skill. Though the acquisition of training options moved generally from the attitude and knowledge domains to the skill domain, the collecting process focused on finding training options that were appropriate to specific training needs. Once the set of training options appeared to be sound in each of the broad categories, a check was made to see that all training needs could be adequately covered by one or more training options. Making final additions and code revisions completed the set of training options.

Acquisition of training options in the attitude and knowledge categories were found in a variety of sources. The Educational Technology Center at the University of Maryland College of Education has a large collection videotapes on numerous topics. All Educational Technology Center materials which might relate to special education were reviewed, and all those which would be useful as training options were described in the training options knowledge base. Similarly, materials, both print and non-print, at the University of Maryland vocational education curriculum laboratory were reviewed, and those useful to SNAP were described in the knowledge base. Descriptions of materials from these two sources included information to help SNAP users locate and acquire them. Materials from these two sources were not stored with other training options. Users must make special arrangements to borrow them.

Other training options in the categories of attitude and knowledge were acquired directly from publishing companies, clearinghouses, foundations, and special educators. Books and pamphlets were generally collected through these sources. Several of the special educators who assisted in the training options collection process were themselves inservice trainers. These individuals not only contributed printed materials; they also provided descriptions of procedures they use in special education inservice (e.g., pairing a teacher with a poor attitude with a colleague who has a positive attitude). Descriptions of many of their activities accompanied be necessary materials, then, became training options.

Skill level training options were mostly found in professional journals and textbooks. Numerous activities were found, for example, in Teaching Exceptional Children. While most skill level training options are teaching strategies appropriate for specific content areas, other skill level training options concern teaching classes with mainstreamed special education students. Still other skill level training options concern effective classroom management. Several training options to help teachers improve their teaching skills were developed specifically for the SNAP training options collection. These included self-observations, peer conferencing, meetings with special educators, and visits to other teachers' classrooms.

The Recommending of Training Experiences. Teachers using the SNAP System receive their training recommendations as the culmination of their interactions with the system. Figure 4 is an example of SNAP System training recommendations as they are presented to the teacher.

Figure 4

Training Recommendations

Analysis is now complete. The following training options are applicable:

Self-Correction for Improving Writing Skills R169 *
Spelling R126
Word Processing to Improve Student Writing R173
Improving Comprehension R170
Vocabulary Centers R184
Dialogue Journals R128
Author's Chair/Peer Conferencing R127
& **
Mathematics and the Special Student R125
Language Experience for Problem Solving in Mathematics R132
Direct Instruction of Mathematics R144
&
Strategies for Teaching Students Who Have Trouble Learning R114
Modifying Classroom Exams for Secondary LD Students R116
&
Conference with Special Education Teacher R76

* R = Record number
** & = Ampersand delineates groups of training options; implication is for teacher to choose one from each group, unless otherwise instructed by inservice trainer.

The two expert systems in the SNAP System work together to assess teachers' training needs and to prescribe individualized training activities. This discussion summarizes activities that were conducted during the development of the system and identifies many of the activities of teachers using the system.

EVALUATION

This section describes the two major evaluation activities conducted on the SNAP System. Evaluation and validation information used in developing the measurement instruments are included in the technical reports found in Appendices F, G, J, N.

SNAP Field Test

A final field test of the SNAP System, an inservice course was delivered to a group of 18 teachers in a school system. They taught grades K-12 and were highly diverse in terms of their backgrounds, interests, and current teaching situations. Because the final field test was in the context of group training, it was essential that course planning focus on the following consideration: Individualized instruction should not isolate individuals from one another. The dynamics of the social contexts should be used to enhance teachers' professional development in the domains of attitude, knowledge, and skill.

Teachers in the final field test SNAP course worked on 8 to 30 training options recommended by the computer. Some teachers pursued all of their training options in great depth, while others skimmed some materials and spent more time with others. Some teachers worked on some activities that others were also working on, providing a ready opportunity for shared learning experiences. Generally, though, the teachers worked independently on their individual activities.

Each teacher was required to write reviews on the recommended training options. Each review included a discussion of the appropriateness of the training option for the teacher and gave a plan for how the teacher could apply the training in his or her mainstreamed classroom. These reviews served two functions. First, they provided a source of data for our evaluation of the SNAP System. Second, they provided a structure for the teachers' work on the training options.

The set of SNAP training materials was mostly available to teachers on the site. Some materials were not available on the site but were easy for the trainees to locate and acquire. Some training options involved activities in the trainees' classrooms or schools. Others involved venturing out into the community.

The major thrust of the course was the individualized work completed by each teacher with the support of the course instructor. However, to make use of social contexts, as previously discussed, we also explored certain large group and small group activities. For example, discussions were held on mainstreaming as a concept and as a fact of teachers' professional lives. Issues such as the impact of special education labels were also discussed in large groups and in small heterogeneous groups. These group activities seemed to bring teachers into closer working relationships with one another, while the content of their work provided a substantive framework for their individualized tasks. Additionally, social contexts brought together individuals with varying attitudes, allowing those with positive attitudes to influence those with less than positive attitudes, an important component in mainstreaming education (Larrivee and Cook, 1979).

In the final weeks of the field test training, teachers gave presentations of one of their assigned training options. With the concept of teachers' individual training needs in mind, some presentations were to the whole class, but others were to special interest groups, for example just elementary teachers or just secondary school teachers. Individual presentations were intended to promote knowledge acquisition, skill development, and/or positive attitude enhancement. All presentations were accompanied by group discussion.

Participants in the final field test of the SNAP System acquired several competencies; these include:

1. Teachers who began the course at information or personal stages of concern regarding mainstreaming advanced to higher level stages of concern such as consequences or collaboration, as measured by the Stages of Concern Regarding Mainstreaming.

2. Teachers acquired increased competence on goals they selected for themselves. A full listing of goals is included in Appendix B.

3. Teachers who were found to be in need of training to improve their teaching effectiveness in the areas of (1) questioning, (2) academic learning time, or (3) direct instruction acquired increased competence in the area(s) of need.

4. Teachers found to need improved attitudes related to mainstreaming developed more positive attitudes, as measured by the Attitudes Toward Mainstreaming scale.

SNAP teachers' attainment of these competencies was measured in two ways: (1) Teachers' attainments were measured in terms of individual course objectives, which were established through SNAP needs assessment, and self-evaluated in conference with the instructor; (2) The transfer of knowledge, skill, and attitudes is evaluated through follow-up evaluation with the teachers in the semester following the SNAP course.

The Role of the SNAP Instructor. The role of the instructor was to facilitate the effective use of the training options. Moreover, it was the instructor's job to see that an individualized training approach became a rich classroom experience with effects reaching into teachers' own classrooms. The group meeting approach allowed new knowledge and skills to be reinforced and extended among peers. Also, the enlightened or positive attitudes of some group members influenced the positive attitude formation of others. The instructor used classroom dynamics to enhance the professional development of teachers enrolled in SNAP. The instructor also assisted teachers in experiencing a deeper commitment to teaching mainstreamed students.

Stages of Concern (SOC) and Attitudes Toward Mainstreaming Scale (ATMS). We administered the Stages of Concern and Attitude tests prior to training and during the last session of training. Means and standard deviations are displayed in Table 1. The improvement in ATMS scores was tested be means of a t-test for dependent samples and found to be statistically significant (t=4.51,17, p < .001).

Table 1
Mean Scores on ATMS
(range 1 to 5)

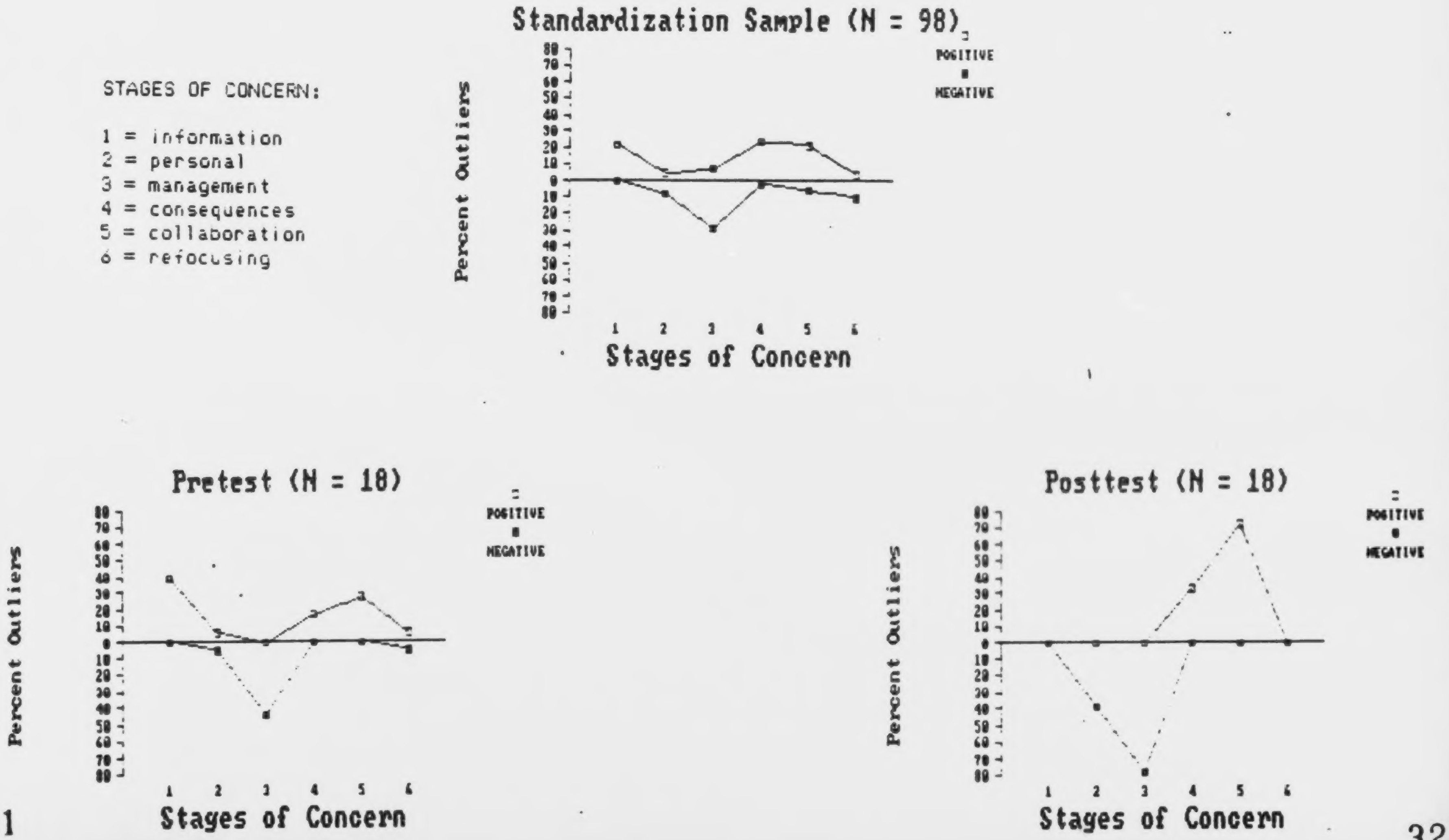
	Prior to Training	After Training
mean	3.5	4.0
SD	.4	.3

The Stages of Concern showed an obvious improvement as displayed in Figure 5. This figure includes graphs of the Stages of Concerns profiles for our final field test trainees before and after training, as well as the profile for our overall standardization sample. The profiles are expressed in percent of the trainees with outliers (as determined by the algorithm developed in our project). 21% of the standardization sample had information concerns, 39% of our trainees had information concerns prior to training, but none had information concerns after training. Management concerns among our trainees were strongly decreased after training, with the number of negative outliers (indicating low levels of concern about management) increasing from 44% before training to 78% after training. In contrast, consequence and collaboration concerns increased, with the percent of positive outliers increasing from 17% and 28% (respectively) before training to 33% and 72% after training.

These results suggest that our training was able to improve attitudes toward mainstreaming and decrease the lower level concerns while increasing the teachers' concerns about the impact upon students, collaboration with other professionals, and widening the benefits of mainstreaming. This sort of movement toward higher levels of concern is

FIGURE 5

STAGES OF CONCERN DATA



STAGES OF CONCERN:

1 = information
2 = personal
3 = management
4 = consequences
5 = collaboration
6 = refocusing

purported to be associated with teacher development in the Stages of Concern model.

Course evaluation. Teachers in our final field test sample completed an evaluation of the SNAP System course. This evaluation was designed to determine the success with which the ss had met the individual training needs of the teachers. The results are displayed below. These ratings are on a 1 to 5 scale, with 5 being positive.

How helpful for learning about:

1. Ideas that can be used in classroom	4.5
2. Teaching students who have trouble learning	4.5
3. Effective teaching	4.5
4. Specific handicapping conditions	4.2

How helpful in developing:

5. Positive attitudes toward students	4.4
6. Positive attitudes toward mainstreaming	4.4

How appropriate for:

7. Grade level	4.3
8. Subject area	4.4
9. Self-selected learning goals	4.0

Other items:

10. Overall attitude toward training options	4.0
11. How well did training options build confidence about teaching special needs students?	4.0
12. Compared with other introductory courses, how well did the training options address specific needs?	4.1
13. Compared with other special education courses, how well did the training options address specific needs?	4.4

The evaluation also included open ended questions. Teacher responses were subjected to a content analysis. The results are presented in Appendix O. All of the teachers considered the course to be a successful learning experience, and 83% attributed this to the quality, variety and usefulness of the training options. A number of improvements were suggested, and several teachers expressed confusion concerning the function of the computer and the self-observations. We feel that this was partly due to the developmental nature of the system, and would be correctable in future administrations of the training.

Expert Validation Study

We conducted a study which compared the training recommendations made by the SNAP System with similar recommendations made by expert trainers. This comparative study was patterned after similar validation studies of expert systems in fields such as medicine. This study was completed in two phases. In Phase One, three expert teacher trainers duplicated the function of the SNAP System in selecting training options for individual teachers on the basis of their needs assessment data. In Phase Two, the recommendations of these three expert trainers were intermixed with the recommendations made by the SNAP System and evaluated by a second group of three expert trainers. These two phases are described below.

Phase One

Three expert teacher trainers were identified through a process of peer nomination. Each was independently identified by two different nominators as having excellent qualifications in this area of inservice training. All three of these people had Ph.D. degrees in special education and several years of experience in teacher training, including the inservice training of regular educators about mainstreaming.

These expert trainers were given the needs assessment information on six of the teachers in our final field test sample and were instructed to make individualized training recommendations by selecting training experiences from the data base of training options. To control for the effects of varying numbers of training recommendations, the expert trainers were given a target number of training options to produce for each trainee. These target numbers were the numbers of training options recommended as highly appropriate by the SNAP System, and varied from 7 to 12. The expert trainers were instructed to contact the experimenters if this target number could not be met, but none elected to do so and all target numbers were met.

The following relevant observations can be made from the results of this first phase:

Agreement Between Recommendations. A question can be asked concerning the degree to which the expert trainers agreed between themselves in the recommendations made for each trainee, and the differences between the SNAP System and the expert trainers in this regard. When the recommendations made by the three expert trainers were paired, the percent of agreements was found to be relatively low, averaging 7.9% agreements. When the recommendations made by the expert trainers were paired with the recommendations made by the SNAP System, the percent of agreements was lower, averaging 5.3%. A distribution is displayed in Table 2.

Table 2
Agreements in Training Recommendations Between
Pairs of Expert Trainers and
Expert Trainers Paired with the SNAP System

Pairings:	Expert/Expert	Expert/SNAP
0% agreements	8	9
Between 0% and 10%	6	6
Between 10% and 20%	2	3
Between 20% and 30%	2	0
	—	—
Total	18	18

These findings suggest that the expert trainers' selection of training experiences was influenced by a number of factors beyond the needs assessment data provided. Informal interviews conducted with the three expert trainers suggested that they tended to draw upon their experiences in using different training techniques, their preferences for specific materials, and certain fundamental assumptions and beliefs about the training needs of regular educators working with handicapped students.

Use of available training options. Across the six test cases, the SNAP System recommended a total of 41 different training options, while the expert trainers recommended a total of between 16 and 21. This finding suggests that the SNAP System has the potential for making better use of large numbers of training alternatives, although it may also reflect differences in the decision making processes used by the SNAP System and the expert trainers. For example, the expert trainers tended to select particularly good training experiences and to recommend them for a number of teachers. The SNAP System simply looked at each individual case and selected sets of training experiences based on their ability to meet multiple training needs.

Coverage of training needs. Based on the coding of the training options, the SNAP System met an average of 89% of the goals and subgoals, while the expert trainers met an average of 53%. The SNAP System met an average of 83% of the needs related to teacher effectiveness, while the expert trainers met an average of 67%. The SNAP System met an average of 50% of the needs related to attitudes, while the expert trainers met an average of 44%. This finding suggests that the SNAP System operates satisfactorily in covering training needs, but since the findings are based on the SNAP System coding, they should not be interpreted beyond this.

Phase Two

The recommendations made by these three expert trainers and by the SNAP System were written in a uniform format, listing an identification number for the trainee and the training options recommended for that trainee. As mentioned previously, all sets of recommendations for each trainee had a constant number of training experiences, ranging from 7 to 12. This number was determined by the number of training experiences that were rated as "highly" appropriate by the SNAP System.

It should be noted that the output of the SNAP System is in the form of "generators". These are clusters of training options separated by an ambersand, for example:

option 1
option 37
option 123

&

option 14
option 66
option 180

&

option 33
option 99

If one option is selected from each cluster, the maximum number of training needs will be met. In translating the recommendation of the SNAP System into a simple list of training options, we did not observe this format and thus may have put the SNAP System at a disadvantage. However, we felt that the expert trainers could not be asked to list their recommendations in generator format.

Recommendations of the expert trainers and the SNAP System were intermixed and presented to a second panel of expert trainers who evaluated the recommendations according to three criteria: (1) the completeness of the training recommendations in meeting individual training needs, (2) the absence of extraneous training experiences, and (3) the overall quality of the training recommendations. Each of these criteria was rated on a 5-point scale with 1 representing the best rating and 5 the worst.

In comparison with the recommendations of the expert trainers, the SNAP System achieved average rankings of 3.25, 2.97 and 3.39 respectively on these three criteria. The SNAP System equalled or surpassed at least one expert trainer on 72% of the ratings for criterion (1), 72% for criterion (2), and 61% for criterion (3). These findings suggest that the SNAP System can successfully duplicate the functions of expert trainers in selecting training experiences.

Discussion

Evaluation components of the SNAP System measured how effectively the System used an expert system to prescribe training recommendations. Effectiveness in this section of the report refers to the validity of the SNAP recommendations as compared to recommendations of human experts and to the use of the SNAP recommendations as course assignments for teachers in a course on mainstreaming. Evaluation findings support the use of the SNAP System as a method of prescribing training activities that are appropriate to the individual interests and needs of individual teachers.

Evaluation data do not suggest that the SNAP System is superior to human expert trainers at recommending training activities. The SNAP System need not be superior to human experts. It need only produce training recommendations that are qualitatively comparable to the recommendations human experts might make. The use of an expert system, after all, can increase the efficiency of the process.

An important consideration in evaluating the SNAP System is that its use indeed fosters an individualized needs assessment and training process. Our evaluation activities suggest that the SNAP System may contribute to the efficiency and effectiveness of teacher inservice training. With this view, the SNAP System may appear as a partner of inservice trainers. Decision-making about appropriate experiences for individual teachers may be facilitated by the SNAP System, so that trainers are free to train.

DISSEMINATION

The findings and products of this special project have been disseminated in the following ways.

Publications and Technical Reports:

Malouf, D.B. (1983) Systematic Needs Assessment Program (SNAP): A computer-assisted needs assessment system for teacher training in special education. Technical Report #200, Institute for the Study of Exceptional Children and Youth, University of Maryland.

Coulson, D.B., Malouf, D.B. & Haynes, J.A. (1985) Adapting the stages of concern about innovation questionnaire to measure teacher attitudes about mainstreaming. Technical Report #201, Institute for the Study of Exceptional Children and Youth, University of Maryland.

Haynes, J.A. & Lubell, J. (1986) Abductive and deductive inference in and expert system for needs assessment in teacher training for special education. Technical Report #202, Institute for the Study of Exceptional Children and Youth, University of Maryland.

Coulson, D.B. & Malouf, D.B. (1986) Exploratory data analysis for descriptive profile development. Technical Report #203, Institute for the Study of Exceptional Children and Youth, University of Maryland.

Haynes, J.A., Pilato, V.& Malouf, D.B. (in press) Expert systems for educational decision making. Educational Technology.

Pilato, V., Malouf, D.B. & Haynes, J.A. (in preparation). Individualizing the professional development of mainstreaming teachers.

Presentations:

Haynes, J.A. & Lubell, J. (1986) Abduction and deduction in an expert system for teacher training in special education. Paper presented at the Annual Meeting of the Association for Behavior Analysis, Milwaukee, WI.

Haynes, J.A. & Lubell, J. Abductive and deductive inference in and expert system. Paper under review for the 3rd IEEE Conference on Artificial Intelligence Applications, Orlando Florida, 1987.

Paper on the SNAP System submitted for 1987 national meeting of American Educational Research Association.

Demonstration of SNAP System to staff members of the Office of Technology Assessment, U.S. Congress, 1986.

Computer Programs, Documentation and Hard Copy Components (to be included in December update of our Institute catalog):

Stages of Concern Program. This program delivers and analyzes the Stages of Concern about Mainstreaming Questionnaire, using the revised SOC and the scoring algorithm described in the section on PROGRAM CONTENT. It should be a useful research tool as well as an instrument for teacher training.

Goal Setting Program. This program administers and records the self selection of learning goals, as described in the section on PROGRAM CONTENT. Its primary use is as a needs assessment instrument for teacher training.

Rules for Analyzing Teacher Self-Observations on the Basis of Research on Teacher Effectiveness.

Data Base of Training Options

Note: These final two products form the basis of the two main expert system components of the SNAP System. Persons purchasing them will be able to include them in expert systems using KES or a similar expert system development programs that are available.

Appendix A

Technical Report #200

Project Overview

Systematic Needs Assessment Program (SNAP): A Computer-Assisted Needs Assessment System for Teacher Training in Special Education

TECHNICAL REPORT #200

Project Overview

Systematic Needs Assessment Program (SNAP): A Computer-Assisted Needs Assessment System for Teacher Training in Special Education

David B. Malouf

October, 1983

Special Project: Microcomputer-Assisted Needs Assessment System for Teacher Training in Special Education

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Abstract

This paper presents the rationale and general description for a computer-assisted needs assessment system for teacher training in special education. This system is termed SNAP (Systematic Needs Assessment Program), and is being developed and tested under a grant awarded by the Division of Personnel Preparation, Special Education Program, Office of Special Education and Rehabilitative Services, U.S. Department of Education.

One innovative feature of the SNAP System is the application of "expert system" principles to integrate and interpret needs assessment data. These programming principles are drawn from the field of artificial intelligence, and allow the computer to apply rules developed on the basis of expert input to guide the trainee through a selective process of needs assessment and self-exploration to arrive at recommendations of specific training experiences which will be of greatest benefit to the trainee.

THE NEED BEING ADDRESSED IN THIS PROJECT

Recent years have witnessed major increases in the expenditure of money and effort to prepare educational personnel to meet the needs of handicapped students. Reasons include the implementation of federal mandates, critical shortages in the supply of qualified teachers in a number of areas related to special education (Morsink, 1982), questions about the qualifications of special and regular education teachers in light of new role functions and demands (Saluzzi, 1981), and a growing awareness of the need to build and maintain an infrastructure of preservice and inservice professional preparation in all areas of education (Hardin, 1982). By all accounts, these training needs pose great challenges for teacher training programs at both preservice and inservice levels.

This paper discusses weaknesses in current approaches to needs assessment in teacher training and describes the basic design principles for a microcomputer-assisted needs assessment system to be used in teacher training in special education. This system which has been termed SNAP (Systematic Needs Assessment Program), is being developed and tested under a grant awarded to the University of Maryland by the Division of Personnel Preparation, Special Education Programs, Office of Special Education and Rehabilitative Services, U.S. Department of Education.

The Need for New Approaches to Needs Assessment in Teacher Training

Any teacher training program must have a process for selecting training objectives and methods for the trainees being served. Ideally, this process should provide a valid and direct answer to the question, "What training experiences should the trainee be given?" This is a critical element, for the quality of training can be no better than the quality of this selection process.

However, in current practice the selection of teacher training experiences is based upon needs assessment procedures which tend to use insufficient data to make decisions which are too general, not individualized, of questionable validity, and which are divorced from the actual procedures of training. The following sections describe the conceptual issues and methodological constraints which limit the effectiveness of needs assessment procedures in teacher training.

Conceptual Issues

There appears to be confusion over what exactly is meant by "need" and "needs assessment". Moreover, there are questions regarding the conceptual models underlying the practice of needs assessment. Scriven and Roth (1978) stated the case quite strongly.

> Needs assessments have been for some time the most ludicrous spectacle in evaluation. The usual "models" are farcical and decisions based on them are built on soluble sand. (p. 25)

Discrepancy Model. One common needs assessment model in special education teacher training is the "discrepancy" model which conceptualizes "need" as the discrepancy between a "current status" and a "target status" (Popham, 1975b). This model is often operationalized by collecting dual evaluations of (a) the importance of a competency, and (b) a current level of the competency. Results are analyzed by calculating differences between the current and target ratings for each competency. Examples were described in Gable, Pecheone and Gillung (1981) and Phelps and Clark (1977). The discrepancy model may also be operationalized by identifying "quality" or "ideal" practices, and conducting a single assessment of the presence or implementation of these practices.

Roth (1977) elaborated the basic discrepancy model by suggesting distinctions between different target states:

1. goal discrepancy: the target is an ideal.
2. social discrepancy: the target is a norm.
3. essential discrepancy: the target is a minimum.
4. desired discrepancy: the target is a desire or want.
5. expectancy discrepancy: the target is an expectation.

The discrepancy model is conceptually simple, relatively easy to implement, and compatible with a management-by-objective approach. Thus its greatest uses may be in prioritizing training areas and making administrative decisions about training programs. However, the discrepancy model has some inherent conceptual weaknesses. Primarily, the discrepancy model captures the quantitative nature of the gap between actual and target states, but fails to encompass factors maintaining the gap or effecting its possible reduction. In other words, it looks at the "hole" but not the "donut".

For example, Scriven and Roth (1978) distinguished between "performance deficits", treatment deficits", and "resource deficits". There may be an obvious discrepancy between a regular educator's ability to teach handicapped students and the ability he/she should have. However, measuring the extent of this "performance deficit" provides no information regarding the "treatment deficits" (e.g. previous training and administrative support) or the "resource deficits" (e.g. available assistance) which may contribute to the discrepancy. Thus, the measurement of the discrepancy only partially answers the question of, "What training experiences should the trainee be given?"

Factor models. The following definitions of "need" differ from the discrepancy model:

> Z needs X = Z would (or does) significantly benefit from X, and Z is now (or would be without X) in an unsatisfactory condition. (Scriven & Roth, 1978, p. 25)

> ...a factor without which a person or group or school system cannot adequately function. (Kuh, et al, 1980, p. 16)

> ...something that can be shown to be necessary or useful for the fulfillment of some defensible purpose. (Stufflebeam, 1977)

In the above three definitions, a need is a factor rather than a discrepancy. An unmet need, then, is the absence of this factor rather than a discrepancy between actual and target states. This type of definition partially answers the previous "donut and hole" criticism by encouraging a focus upon qualitative rather than quantitative aspects of an unmet need. However, needs assessments based on such "factor" definitions present certain difficulties. Such assessments require prior delineation of necessary or useful factors (Roth, 1977). This process is far from trivial in light of the complexity and variability of educational environments. The value of such factors may vary greatly for different teachers and situations. The presence or absence of a factor may not be readily discernable, but instead may need to be inferred from multiple variables such as instructional problems, teacher values, and available resources.

A Conceptual Basis for the SNAP System

Any attempt to develop a needs assessment system for teacher training should begin with the fundamental question, "What training experiences should the trainee be given?" No single current conceptual model of needs assessment adequately encompasses the scope of this question.

Discrepancy models are easily implemented and can identify areas of concern which may be improved through teacher training. However, these models are relatively barren of information necessary for the selection of training experiences. Factor models lend themselves to qualitative analysis of the training problem, but do not currently provide an adequate basis for the integration of different variables in determining needed training experiences.

The SNAP system will incorporate elements of both discrepancy and factor models. Consistent with discrepancy models, training needs will be determined in part on the basis of discrepancies between actual and ideal states. The use of "goal discrepancy" (Roth, 1977) will not limit the system to selecting training experiences required for adequate performance, but will also include training experiences to lead trainees at any level of functioning toward an ideal target level of functioning.

Consistent with factor models, the system will be designed to select training experiences which are "necessary or useful" (Stufflebeam, 1977). The SNAP system will consider multiple variables (teacher attitudes, classroom events, available resources, etc.) in selecting these training experiences.

Methodological Constraints

Methodological weaknesses currently exist in (1) the collection of needs assessment information, and (2) the processing and interpretation of information. These weaknesses can be further described as follows:

1. Limitations in the collection of information. In current practice, if teacher training experiences are

adapted to trainee needs at all, they are primarily selected on the basis of trainee self reports which are conducted by means of written questionnaires or (less frequently) interviews. Such methods are subject to the following criticisms:

(a) Trainee self-reports tend to confuse "wants" with "needs," or "perceived needs" with "real needs" (Kuh, et al., 1980; Mann, 1980). For example, a regular education teacher may report a high need for training in categories of handicaps when in reality he/she would benefit more from training in instructional methods for diverse students. A special education teacher may report a high need for training in content area instruction when in reality he/she would benefit more from training in collaboration with regular content area teachers.

Both affective and cognitive factors may contribute to this problem. A regular education teacher may report a high need for training in categories of handicaps because he/she mistakenly overestimates the value of this information in teaching handicapped students. A vocational education teacher may report a high need for training in equipment modification because he/she visualizes most handicapped students as having physical disabilities and is afraid of the occurrence of injuries.

(b) Data collection procedures tend to confuse "needs" and "goals". They do this by asking trainees with limited knowledge of the training area to respond to items describing specific goals. For example, items taken from published needs assessment instruments ask respondents to rate their needs to learn more about how to do the following:

(1) "Identify learning disabilities"

(2) "Develop positive reinforcement techniques"

(3) "Employ techniques or principles of special instruction (e.g., discrimination learning or cue redundancy)"

In these items, terms are employed which are likely to be misunderstood by the intended audience. For example, the term "learning disabilities" is often misused by regular educators as a general term for educational handicaps. Moreover, concepts in these items require prior knowledge which is not likely to be found among many training audiences. For example, to rate item 2, the trainee should know what "positive reinforcement techniques" are, what they do, how to recognize a need for them, and if they are appropriate to his/her setting.

Why are such questionable items used? One reason may be that they appear to relate directly to training. If a person reports a need for training in "positive reinforcement", then training can be given on "positive reinforcement". In contrast, an item dealing with a need for "behavior management" may be more consistent with the trainee's initial knowledge and understanding, but does not suggest specific training experiences. Thus, information limitations in current methodologies may force the trainer into choosing between items which are appropriate for the trainees but have unclear implications for training, or items which have clear implications for training but are not appropriate for the trainees.

(c) Other types and sources of information are rarely utilized as completely as they should be. One valuable but frequently neglected type of information is the environment in which the problem or need occurs. Bronfenbrenner (1979) argued for the ecological analysis of problems, including consideration of specific and general environments in which they occur. Teacher self-reports rarely address this type of information adequately.

Another underused source of information is the teacher performance test or observation (Popham, 1975a). What could have more obvious implications for teacher training than an inventory of current strengths and styles which can be built upon, and current weaknesses which should be corrected? However, for various technical and practical reasons, such information is rarely collected, much less used.

2. Limitations in the processing and interpretation of information. Even if sufficient reliable information were collected, it would be of little value unless it were processed and interpreted appropriately. Weaknesses related to these functions include the following:

(a) Current methodologies are inadequate for integrating and synthesizing large amounts of information of different types collected from different sources (Mann, 1980). Consider a hypothetical case in which training decisions are to be made for 15 teachers on the basis of needs assessment information consisting of self-ratings on 30 possible perceived needs, observations regarding 20 factors related to each trainee's teaching, and 20 factors in the school and community environments. This example represents both a substantial increase from current needs assessments and a minimum when the ideal is considered. Processing and interpretating these 1,050 pieces of data would constitute a formidable task for existing methodologies.

(b) There are few validated principles upon which to base selection of teacher training experiences. Even with the availability of sufficient reliable information and a means to process it, there would be little basis for decision making. In recent years, notable efforts have been made to identify quality training practices (National Inservice Network, 1980) and effective teaching procedures (Denham & Lieberman, Eds., 1980; Stevens & Rosenshine, 1981). However, this information represents a mere beginning to the information that is needed. Further, general principles of teacher training and education are developed without attention to the conditions affecting their relative importance and value. For example, research may suggest that effective instruction is teacher-directed, academically focused, individualized, and takes place in groups (Stevens & Rosenshine, 1981). However, how does a teacher trainer decide if a specific trainee needs to learn methods for group instruction, or individual instruction, or teacher direction? In which conditions is each technique most important? How does one measure the level of need? And finally, how are these principles translated into the selection of specific training experiences?

A Methodological Basis for the SNAP System

Current methodologies for needs assessment in special education teacher training are not adequate to collect and process the necessary information. The SNAP system will employ the information processing capabilities of the microcomputer enhanced with "knowledge-based expert system" programming principles to expand these capabilities. The following basic methodological principles will be observed:

A. Collection of Information

1. Multiple types of information will be employed, including student performance, teacher performance, and situational factors.

2. To the greatest possible extent, each type of information will be collected from the best available source. For example, trainees will not be asked to respond to statements for which they may not have the necessary informational background. Also, attitudinal and possible observational biases will, to the extent possible, be eliminated as sources of misinformation.

B. Processing and Interpretation of Information

1. Extensive and varied information will be combined and integrated in the process of selecting training experiences.
2. Expert input and research data will be used intensively in the formulation of the decision rules used to select training experiences.
3. The results of the needs assessment process will be expressed in terms of specific training experiences which can be directly implemented and evaluated.
4. A feedback mechanism will be included to allow the continued development and revision of decision rules on the basis of trainee experience.

Additional Design Considerations

In addition to consideration of the above conceptual and methodological issues in needs assessment, the SNAP system will be designed to allow needs assessment to become an on-going, responsive and integral component of the training process, consistent with principles of teacher development and adult learning such as the following:

1. Teacher needs change qualitatively and quantitatively during the course of teacher development (Fuller, 1969; Hall & Loucks, 1978). Such changes have important implications for the process of teacher training and should therefore be monitored on an on-going basis. At an appropriate level of development, needs assessment procedures will be capable of serving this function.
2. Needs assessment itself should be an educational process (Kuh, et al., 1980). As such, the process

should conform with principles of adult learning such as the following (Banks, 1981):

(a) Learning should be self-directed. The SNAP system will treat the trainee as an active participant in the assessment process by providing frequent feedback and by providing explanations for assessment decisions. The trainee will be able to trace the consequences of various types of input, and to provide feedback regarding the validity of the system.

(b) Learning should tap the adult learner's previous experience. As adults, teacher trainees have an accumulation of previous experiences to which they tend to relate new learning, and which can serve as a foundation for training. The SNAP system has the capability of including previous experience as a factor in the decision-making process while at the same time including a variety of other important factors.

(c) Learning should be problem-oriented. The trainee should recognize the direct relevance of training to solving problems or performing tasks that are required of him/her. In some cases, the trainee may need to be shown this relevance. The SNAP system will conform to this principle in two ways. First, it will select training experiences which will be of use to the trainees. Second, it will allow the trainee to see the relevance of training selections by providing feedback and explanations during the course of assessment.

The above principles are sometimes misconstrued to support an adult version of a "free school" in which needs assessment would simply involve asking the trainee, "OK, what do you want to learn?" The process is in fact more complex that this, and requires a needs assessment system which can be both flexible and structured, both interactive and directive, and which can accept assessment data in the available forms and provide feedback and recommendations based on expert insights.

Summary of the Need and Design Considerations for the SNAP System

Needs assessment approaches in teacher training are not currently adequate for performing the functions for which they are intended. Conceptually, they are unable to integrate and encompass all aspects of the fundamental question, "What training experiences should the trainee be given?" Methodologically, they are limited by the inability to collect and process the information needed to select training experiences. The SNAP system is an attempt to exploit the capabilities of microcomputers in collecting, storing and processing information to allow needs assessment procedures to perform their intended functions more completely and consistently with principles of teacher development and adult learning.

INITIAL DESCRIPTION OF THE SNAP SYSTEM

Many features of the SNAP system have not yet been determined, thus the following description (based on initial proposed plans) should be considered as tentative.

The Functions of the Microcomputer

The microcomputer will be central to the needs assessment process. The most innovative function will be to serve as an "expert system." As such, the SNAP system will duplicate to a limited degree the process of expert consultation that might be provided if each teacher trainee were able to engage in an extended interaction with a panel of experts. We do not propose to develop a "state of the art" expert system, but instead intend to focus on the application of existing products and technology to a new task.

The expert tasks to be performed by the system can be characterized as: (a) To monitor the needs assessment process and make selections of items or tasks on the basis of multiple rule elements. (b) To select training experiences for individual trainees on the basis of a large quantity and variety of collected data.

Characteristics of the Expert System

The proposed system has a number of significant design characteristics relevant to expert system development. These include the following:

1. Relatively small solution space. We anticipate an initial system design which will have the capacity for differentially selecting training experiences from a "solution space" of approximately 250 to 300 specific training alternatives. This represents our best estimate of an appropriate balance between manageability and nontriviality in initial system development. If the approach proves to be successful, there is virtually no limit to the number of training alternatives that can be included in a solution space.

2. Microcomputer implementation. Until recently, rule-based systems have been designed to run on large main-frame computer systems. However, recent systems run quite effectively on microcomputers. This is largely due to advances that have occurred in computer hardware technology.

3. Production rule structure. The representation of knowledge within computer systems is a matter of continued development in the field of artificial intelligence. Our initial plans are to employ production rules which can be

viewed as IF-THEN rules. Each rule is generally formulated to represent a "chunk" of knowledge. Most systems contain hundreds of such rules arranged into networks according to the relationships between rules.

4. Systematic uncertainty. One problem we face in developing the proposed system is the unavoidable presence of (a) uncertainty in the production rules, and (b) unreliability in the needs assessment data collected. The problem of inexactitude has been faced in the development of other rule-based expert systems.

Davis, et al., (1977) describe use of "certainty factors" in the MYCIN system to accomodate the judgemental and inexact nature of medical diagnostic rules. An example is provided in the following INTERLISP code:

```
premise: ($AND(SAME CNTXT INFECT PRIMARY-BACTEREMIA
              (MEMBF CNTXT SITE STERILESITES)
              (SAME CNTXT PORTAL GI)

action:  (CONCLUDE CNTXT IDENT BACTEROIDES TALLY .7)
```

English translation:

If (1) the infection is primary-bacteremia, and
(2) the site of the culture is one of the sterilesites, and
(3) the suspected portal of entry of the organism is the gastrointestinal tract,
then there is suggestive evidence (.7 out of 1) that the identity of the organism is bacteroides.

The certainty factor in the above rule is 0.7. These factors can vary from -1 (complete disbelief) to +1 (complete belief). The certainty of a hypothesis is the algebraic sum of the certainty of evidence for and against it. One advantage of this particular model of inexact reason is it allows the simultaneous accumulation of evidence supporting and against a given hypothesis. Shortliffe and Buchanan (1975) describe the model in detail.

The above approach to uncertainty has been criticized as possibly being "unnecessarily ad hoc" in that the developers of MYCIN have formulated their own model of inexact reasoning when there are other, more throughtly-studied models available (Stefik, Aikens, Balzer, Benoit, Birnbaum, Hayes-Roth, and Sacerdoti, 1982). Another alternative would be to apply Bayes' Rule to calculate the probability of a disease in light of evidence and conditional probabilities. The main difficulty with this approach is the quantity of data required to determine conditional probabilities. A compromise approach described by Duda, Hart, and Nilsson (1976), and Pednault, Zucker, and Muresan (1981) involves the use of subjective estimates rather than rigorous data to determine probabilities.

Control Strategy and Data Input. There are two basic processes for applying the rules in the rule-based system to a given set of data (i.e. problem). One approach is termed "forward chaining", "antecedent reasoning", "data driven", etc., and the other approach is termed "backward chaining", "consequent reasoning", "goal driven", etc. (Duda & Gaschnig, 1981). These two basic approaches are sometimes found in combination.

In the forward chaining approach, the initial data are scanned until a rule is evoked. This rule is applied, leading to a change in the data base, and the scanning resumes. This process continues until a goal is reached. An example of this approach can be found in the INTERNIST system for medical diagnosis. In this system, an initial set of symptons and other data evoke a set of disease hypotheses. For each hypothesis, the system begins to accumulate evidence consistent with the hypothesis, evidence contradictory to the hypothesis, and evidence which should be observed if the hypothesis is correct. Eventually, supportive and contradictory evidence accumulate to the selection of a most likely disease model and treatment (Kulikowski, 1980).

In the reverse chaining approach, rules are scanned consistent with a given goal. If antecedents are found to match the predicates of the rule, then the problem is solved. If not, then the new goal becomes the arrangement of antecedents to match the requirements of the rule, and the process continues. An example of this approach can be found in the MYCIN system for medical diagnosis. In this system, goals are diagnostic conclusions. If a goal is evaluated successfully (a certainty factor greater than .2) the conclusion is made. If the goal is evaluated unsuccessfully, it is bypassed. If the goal cannot by evaluated, the evaluation of the goal becomes a new subgoal and the process continues (Davis, et al., 1977).

Both control strategies call for a degree of interaction between the expert system and the person being "advised." Initial data will be entered, the system will apply rules, more data will be requested, more rules will be applied, and so on until solutions have been found. The following example is taken from the PROSPECTOR system which applies both forward and reverse chaining approaches (Duda & Gaschnig, 1981):

> Computer: To what degree do you believe that the target area is in a continental-margin mobile belt?
>
> Person: 4
>
> Computer: Do you know the age of the continental-margin mobile belt?
>
> Person: WHY

Computer: The vast majority of porphyry copper deposits are younger than 200 million years. Major age groups include...<The computer explanation continues>...

Computer: Do you know the age of the continental-margin mobile belt?

Person: YES

Computer: What is the age of the continental-margin mobile belt?

Person: CRETACEOUS = 65 - 136 MILLION YEARS

Computer: What is your confidence in this estimate?

Person: 3 ...<The consultation continues>...

Final decisions have not been made regarding the control strategy of our proposed system. We currently anticipate that both forward and reverse chaining strategies will be employed.

In contrast to some other rule-based expert systems, the trainee will not come to the computer with answers to all of the questions that may be asked. Thus the interaction between trainee and computer will be discontinuous. The initial needs assessment tasks will include an interactive survey of perceived needs, structured school-based observations, and entry of the results of these observations into the computer. The computer will then select other questions and assessment tasks, and the trainee will answer the questions and/or make further observations for later entry into the computer. This "punctuated interaction" will take place over a minimum of two or three sessions and will be structured with frequent feedback to maximize its value as a learning experience.

REFERENCES

Banks, B.B. The relationship of adult learning theory to inservice training. In M.P. Gaasholt & N.G. Haring (Eds.) Organizing for change: Inservice and staff development in special education. Seattle: University of Washington, Program Development and Assistance System, 1981.

Bronfenbrenner, U. The ecology of human development. Cambridge, MA: Harvard University Press, 1979.

Davis, R., Buchanan, B., & Shortliffe, E. Production rules as a representation for a knowledge-based consultation program. Artificial Intelligence, 1977, 8, 15-45.

Denham, C., & Lieberman, A. (Eds.). Time to learn. Washington, DC: National Institute of Education, 1980.

Duda, R.O., & Gaschnig, J.G. Knowledge-based expert systems come of age. Byte, 1981, 6, (9), 238-280.

Duda, R.O., Hart, P.E., & Nilsson, N.J. Subjective Bayesian methods for rule-based inference systems. SRI International, Artificial Intelligence Center Technical Note 124, January, 1976.

Fuller, F.F. Concerns of teachers: A developmental characterization. American Educational Research Journal, 1969, 6 (2), 207-226.

Gable, R.K., Pecheone, R.L., & Gillung, T.B. A needs assessment model for establishing personnel training priorities. Teacher Education and Special Education, 1981, 4 (4), 8-14.

Hall, G.E., & Loucks, S.F. Teacher concerns as a basis for facilitating and personalizing staff development. Teachers College Record, 1978, 80 (1), 36-53.

Hardin, V.B. Designing continuing education programs for special educators. Exceptional Education Quarterly, 1982, 2 (4), 69-76.

Kuh, G.D. The state of the art in needs assessment in education. In Training Needs Assessment Task Force, National Inservice Network. Needs assessment for inservice education: Building local programs. Reston, VA: ERIC Clearinghouse on Handicapped and Gifted Children, 1980.

Kuh, G.D., Hutson, H., Orbaugh, T., & Byers, K. Needs assessment in regular education inservice training.

Teacher Education and Special Education, 1980, *3* (1), 15-21.

Kulikowski, C.A. Artificial intelligence methods and systems for medical consultation. *IEEE Transactions on Patterns Analysis and Machine Intelligence*, September, 1980, volume *PAMI-2* (5), 464-476.

Mann, P.H. Critical issues and persistent problems. In Training Needs Assessment Task Force, National Inservice Network. *Needs assessment for inservice education: Building local programs*. Reston, VA: ERIC Clearinghouse on Handicapped and Gifted Children, 1980.

Morsink, C.V. Changes in the role of special educators: Public perceptions and demands. *Exceptional Education Quarterly*, 1982, *2* (4), 15-25.

National Inservice Network. Quality practices task force final report. *Inservice*, 1980 (October), 19-21.

Pednault, E.P.D., Zucker, S.W., & Muresan, L.V. On the independence assumption underlying subjective Bayesian updating. *Artificial Intelligence*, 1981, *16*, 213-222.

Phelps, L.A., & Clark, G.M. Personnel preparation for vocational programming or special needs students: Some considerations and guidelines. In L. Albright & G.M. Clark (Eds.), *Preparing vocational and special education personnel to work with special needs students: A teacher education resource guide*. Urbana-Champaign, IL: Bureau of Educational Research, University of Illinois, 1977.

Popham, W.J. Applications of teaching performance tests in preservice and inservice teacher education. *Journal of Teacher Education*, 1975, *26*, 244-248. (a)

Popham, W.J. *Educational evaluation*. Englewood Cliffs, NJ: Prentice-Hall, 1975. (b)

Roth, J. Needs and the needs assessment process. *Evaluation News*, 1977, *5*, 15-17.

Saluzzi, D. An evaluation of the reading knowledge of selected learning disabilities teachers. Unpublished doctoral dissertation, University of Missouri-Columbia, 1981.

Scriven, M., & Roth, J. Special feature: Needs assessment. *Evaluation News*, 1978, *8*, 20-29.

Shortliffe, E.H., & Buchanan, B.G. A model of inexact reasoning in medicine. *Math. Biosci*., 1975, *23*, 351-379.

Stefik, M., Aikine, J., Balzer, R., Benoit, J., Birnbaum, L., Haynes-Roth, F., & Sacerdoti, E. The organization of expert systems, a tutorial. Artificial Intelligence, 1982, 18, 135-173.

Stevens, R., & Rosenshine, B. Advances in research on teaching. Exceptional Education Quarterly, 1981, 2 (1), 1-9.

Stufflebeam, D.L. Needs assessment in evaluation. Paper presented at the meeting of the American Educational Research Association, Evaluation Conference, San Francisco, 1977.

Appendix B

Learning Goals

Learning Goals

Instructions for the Questionnaire

Please rate the degree of usefulness that each learning goal would be for you on a scale of 1 to 5 (1=not useful; 2=slightly useful; 3=moderately useful; 4=highly useful; 5=essential).

For example:

This learning goal is not useful to me now. 1 2 3 4 5 1
This learning goal is essential to me now. 1 2 3 4 5 5

1	2	3	4	5
NOT USEFUL	SLIGHTLY USEFUL	MODERATELY USEFUL	HIGHLY USEFUL	ESSENTIAL

I would like to learn more about. . .

1. special education procedures in my school ______
2. special education services that are available in general ______
3. approaches to working with special education students ______
4. the types and characteristics of students served in special education ______
5. the learning problems that students can have in school ______
6. how to obtain instructional help in my classroom from special educators ______
7. how to use classroom aides ______
8. how to gain access to instructional materials, equipment, etc. for mainstreamed students ______
9. how to obtain additional information about mainstreamed students in my class ______
10. how to work with other educators on tasks relate to mainstreaming ______
11. how to select and adapt materials to teach students who have trouble learning ______
12. how to teach students who are having trouble learning ______

1	2	3	4	5
NOT USEFUL	SLIGHTLY USEFUL	MODERATELY USEFUL	HIGHLY USEFUL	ESSENTIAL

I would like to learn more about. . .

13. how to encourage desirable social interactions between special education and non-special education students ______

14. how to provide instruction for slower students without disrupting instruction for other students ______

15. how to analyze student learning problems to determine how to deal with them ______

16. how to deal with the issue of grading students fairly when they vary widely in ability ______

17. how to keep better track of how students are doing in my class ______

18. how to determine students' skill level in relation to what I teach ______

19. how to determine students' study skill levels in relation to what I teach ______

20. how to interpret assessment results in a student's records ______

21. the behavioral and motivational problems that students can have in school ______

22. how to identify students with behavioral or motivational problems ______

23. how to deal with students' behavioral or motivational problems ______

24. how to confer with parents ______

25. why I should be working with special education students ______

Appendix C

SNAP Self Observations

SNAP Self-Observations

This packet contains the self-observation forms and directions that you will need for phase 2 of SNAP needs assessment. Before you go any farther, please take heed of the following advice:

1. The observations do not need to be done in 1-2-3 order. Preview the entire packet, then select the observation you would like to do first.
2. The class list with performance rating, which accompanies Observation #2, must be filled out for both Observation #2 and #3. To protect the anonymity of your students, you may use first names with or without last name initials.
3. Read directions to an observation form and examine the form itself very carefully before performing a self-observation.
4. Select typical school weeks for observations--typical in the sense of the usual interruptions for this time of the year.
5. Observation periods of 5 days are best, but 4 days may suffice. A week of observing does not have to begin on Monday; if you begin on a Wednesday, end on the next Tuesday.
6. Keep all records of your observations, all labeled with dates, times, class periods, etc. Bring your records, i.e., self-observation forms, to your scheduled computer session.

SECONDARY TEACHERS AND ELEMENTARY SPECIALISTS:

- Observation #1: Use the word "planning" on top and bottom sections of form to indicate times you have planning period, team meetings, etc. "Planning" belongs in the "purpose" blank and the "topic" blank. Also, please mark (with an asterisk) the times you were teaching students whom you observed in Observations #2 and #3.
- Observations #2 and #3 should be of the same class.

EVERYONE:

If you need HELP, contact either Jennie Pilato or Jackie Haynes at 454-6921, or at our home numbers:

Jennie - 490-3403 (Laurel)
Jackie - 279-2217 (Rockville)

Directions for Observation 1

This instrument may be used as a self-observation, or it may be done by someone else. The purpose of the observation is to determine how much of the school day is allocated for instruction, and how much of it is actually used for direct instruction.

The observation period lasts for one week at a time. It may be repeated several times throughout the school year to account for seasonal variations in school schedules (such as Christmas festivities, Spring outdoor activities, etc.).

If you are using Observation 1 as a self-observation, begin by selecting a week for the observation that has a full five days of school attendance. Make sure you have five copies of the observation form (one for each day), and that you understand the directions thoroughly.

Each day, begin by completing the information requested at the top of the page regarding day (of the week), grade, subject (if elementary and non-departmentalized, leave blank; otherwise, indicate the specific subject you teach), beginning and ending times of the scheduled school day, and the number of students in attendance on that day.

Throughout the day, each time the activity changes, record the event if it is either "out-of-class" time (lunch, recess, assembly, PE, music, etc.), or "teaching time," (a period where you, the teacher, are teaching either a subgroup or the whole class). For both of these, indicate the beginning time and ending time of the activity. Indicate the actual times of the activities, not including time required for transition to the activity, moving through the hall, etc. For teaching time, indicate the number of students to whom your specific instruction is directed (the 12 students in a reading group, 24 of the 30 students in your class if the other 6 are working on a group project at that time, etc.). Be as specific as possible in indicating the topic of instruction (adding 3-digit numbers, compound words, etc.).

If additional sheets are needed, simply indicate the day of the week and your name at the top of the second sheet.

For the greatest degree of accuracy, complete the starting and stopping times as they occur, and the rest of the information as quickly as possible upon completion of the activity. Your accuracy in reporting times is important to the validity of this instrument.

Observation 1

Day:________ Teacher:______________ Observer:______________________

Grade:__________________________ Subject:______________________

Average class size:____________ No. of subgroups:___________

School begins:________________ School ends:____________________

Out-of-class times: begin:______________ begin:________________
end:______________ end:________________
purpose:______________ purpose:________________

begin:______________ begin:________________
end:______________ end:________________
purpose:______________ purpose:________________

- -

Teaching time:

#1
begin:________________
end:________________
#students:______________
topic:__________________

#2
begin:________________
end:________________
#students:______________
topic:__________________

#3
begin:________________
end:________________
#students:______________
topic:__________________

#4
begin:________________
end:________________
#students:______________
topic:__________________

#5
begin:________________
end:________________
#students:______________
topic:__________________

#6
begin:________________
end:________________
#students:______________
topic:__________________

#7
begin:________________
end:________________
#students:______________
topic:__________________

#8
begin:________________
end:________________
#students:______________
topic:__________________

#9
begin:________________
end:________________
#students:______________
topic:__________________

#10
begin:________________
end:________________
#students:______________
topic:__________________

Directions for Observation 2

This instrument may be used as a self-observation, or it may be used by someone who is observing in a classroom. The purpose of this observation is to determine the pattern of response opportunities offered to students.

The observation period lasts for one week, two times per day. Each observation period should last for approximately 15 minutes and should coincide with activities where you will be interacting frequently with the students. The procedure may be repeated several times throughout the school year to account for variations determined by students' studying different content areas taught through different media or teaching styles.

If you are using Observation 2 as a self-observation, begin by selecting a week for the observation that has a full five days of school attendance. Make sure you have sufficient copies of the needed forms for both whole class and group observations for the entire week, and be certain that you understand the directions thoroughly.

Observation times should be selected each day so that over the course of the week observations will be obtained for a representative sample of the various teaching-learning situations which occur in your classroom. Elementary generalists should choose mornings and afternoons, large and small groups, a variety of small groups, academic and non-academic content areas, and a variety of academic content areas (language arts, math, social studies, etc.). Secondary teachers and elementary specialists should observe the same class each day but do observations of different times in the class period and different types of instruction, such as small group and whole group teaching.

After you have selected the instructional settings you wish to include, prepare a seating chart for your entire class, leaving ample space in each block to record student interactions. Samples of several types that can be used successfully are attached. Copy your seating charts so that you have enough copies to last for the week (unless you expect to change seating arrangements within the observation period). For observations to be conducted with small groups, either a seating chart or simply a list of group members may be used, depending upon the size of the group, seating practice (assigned or unassigned), and other factors that will influence the convenience of the observation form for you.

Complete the class list form at the beginning of the week for all students that you teach. The estimate of overall performance level should be your own beliefs (independent of test scores, grades, etc.) about their actual performance, not potential or ability level.

At the beginning of an observation period, fill out the coversheet for the observation. Class size should indicate the number of students actually in attendance at the time of the observation (not including those who may be absent from school, at band, working with a specialist, etc.). Group size should indicate the same information, if you are observing the instruction of a group within the class. Then indicate whether the observation is a whole class or group observation.

Select a seating chart or list that corresponds to the situation you are observing. Using the appropriate seating chart or list, "X" out any individuals who are not present at the time of the observation. Then begin your normal instruction. Then proceed as follows, depending on the day of the week:

Monday, Wednesday, Friday

As students respond, indicate either in the block indicating their seat or the line next to their name the type of response. Use the appropriate code indicated on the observation sheet. Write a "V" if the response is voluntary, "R" if it is recruited, "O" if the student is responding in a designated order, "Q" if the student asks an unsolicited question, and "C" if the student makes an unsolicited comment. The order of these on the seating chart is unimportant. Continue coding student responses as they are given until the time for the observation is over.

Tuesday, Thursday

As students respond, indicate either in the block indicating their seat or the line next to their name the correctness of the response. Use the appropriate code indicated on the observation sheet. Write "A" for an appropriate response, "I" for an inappropriate response, "DK" for a "don't know" response or no response. Note that these may be right or wrong answers to questions that have such answers, or they may be comments or responses indicating a student's understanding of a higher-level question that has no explicit right or wrong response.

Observation 2
Coversheet

Day:______________________ Teacher:______________________

Starting time:______________ Grade:______________________

Ending time:________________ Subject:______________________

Class size:_________________ No. of subgroups:____________

Class/Group lesson:_________ Group size:__________________

- -

Student Response Codes: (Monday, Wednesday, Friday)

V -- voluntary response (hand raised, or other means of volunteering a response are indicated)

R -- recruited response (the student's response was requested by the teacher without the student giving any indication that he/she wants to respond)

O -- ordered turn (the student was responding in turn without any consideration given to any student's desire to repond or not respond)

Q -- the response is a question by the student which was not solicited by the teacher

C -- the response is a comment by the student which was not solicited by the teacher

Student Response Codes (Tuesday, Thursday)

A -- the response is appropriate for the question asked. It is either correct, or indicates that the student fully understands the content of the question and responds accurately.

I -- the response is inappropriate for the question asked. It is either incorrect, or indicates that the student does not understand the content of the question and is unable to respond accurately.

DK -- the students responds that he/she does not know the answer to the question(s) asked, or refuses to respond to the question.

Class List for Observation 2

Name	Performance*	Name	Performance*
1.		19.	
2.		20.	
3.		21.	
4.		22.	
5.		23.	
6.		24.	
7.		25.	
8.		26.	
9.		27.	
10.		28.	
11.		29.	
12.		30.	
13.		31.	
14.		32.	
15.		33.	
16.		34.	
17.		35.	
18.		36.	

*Performance - identify as "high", "medium", or "low"

Josh	Danny
Philip	David
Melissa	Susan

Ilene	Yasamin	Debbie
Fred	Paul	Eric

Sharon	John
Marcus	

Joe
Dick
Andy
Steve

Danielle
Stacy
Evan
Ellen

Karen	Joanne	Phil	Bob	Wayne
Emily	Wendy	Brian	Edward	Frank
Ben	Dan S.	Liz	Sherry	Michelle
Skip	Michael	Martha	Hank	Erica
Dave	Jenny	Joel	Carol	Sanjay
Cathy	Sue	Mark	Dan J.	Roger

Instructions for Observation 3

The purpose of this self observation is to gather information about the proportion of time students are actually engaged in learning activities and their success level. Research on student achievement indicates that "engagement rate" is a good predictor of student achievement, particularly when it is combined with students' success level and the overall amount of time spent in learning activities. For this observation, you will be collecting information about the engagement rate of six students. The observation will take place over the period of one week (five school days). Before beginning the observation, make sure that you have enough copies of the observation form. You will need two sets of forms for each day. The specific procedures are outlined below:

1. Each day, select two time periods of ten minutes each when it will be possible for you to observe the students you selected. These should be times that you will not be involved directly in teaching, since conducting the observation will require your attention. These time periods can be either during independent seatwork, when an aide or student teacher is teaching, or at another time that seems suitable to you.

2. At the appropriate time, take the coding sheet for Observation 3, and fill in the activity description information at the top of the page. Be as specific as possible.

3. Sit where you can see all of the specified students, or, if it is your normal practice, circulate around the room so that you will be able to see what the specified students are doing. DO NOT INFORM THE STUDENTS THAT THEY ARE BEING OBSERVED. Also, sit where you can see a clock with a second hand, or wear a watch with a second hand.

4. Once each minute, for a total of ten minutes, indicate on the coding sheet for Observation 3, FOR EACH OF THE SIX STUDENTS whether the student is

on task -- actually engaged in performing appropriate tasks related to learning the content of the instructional activity. Examples of on-task behaviors might be: writing an answer, reading an appropriate selection from the text, thinking about an answer, measuring, cutting, discussing, or listening. Of course, many of the decisions you will make about whether or not a student is on-task will be inferred from their overt behavior. For example, if a student's eyes are directed toward a book, you would probably infer that he/she is reading, although it is entirely possible that he/she is only staring at it while thinking about their vacation or tonight's party. Similarly, if a student seems to be daydreaming for a period of time, it is possible that he/she is deeply engrossed in performing a problem-solving task, or attempting to remember an important fact. Simply make the best guess you can about the student's behavior.

related -- the student is on-task, but is not performing the actual learning tasks associated with the activity. Examples of related activities would be finding the right page, sharpening a pencil, waiting for a CAI program to load, reading directions, finding the right page in a book, etc. These activities are both appropriate and necessary for performing the learning activities, but are not part of the learning itself.

off task -- the student's current behavior is not related to the learning task assigned. The behaviors may or may not be disruptive, and may or may not be appropriate for some other learning task (such as doing math homework when he/she is supposed to be writing spelling words), but is not appropriate for the specific, assigned task.

For each minute of the 10-minute observation period, one of these choices will be indicated. If it is impossible to observe a student for one of these time slices, put an X over the entire block. At the completion of the 10-minute observation period, indicate any additional comments you have about a particular student.

If it will help you, you may write the name of the student on top of the corresponding student number for each time slice, or at the top of each page. Make sure, however, that the student number corresponds to the number given to you by the computer for that student. This is important because the computer will be using its database about specific students to evaluate their engagment rate.

Following each 10-minute observation period, collect the work that the student was doing, and give an overall rating as to whether the student's success at the task he/she was performing was high, medium, or low. These are overall, subjective evaluations, but should follow the general guidelines as follows:

High success--90% or more correct responses
Medium success--75% - 90% correct responses
Low success -- less than 75% correct responses

These guidelines can be based on evaluations of written work, or responses given by students to questions asked during the observed instructional period.

The computer will prompt you to enter the information from Observation 3 as it is needed.

Observation 3

Activity:

Whole class_______ Group__________ Individual_________

Teacher-directed________ Group work______Independent_______

Description:

- -

Time Sample 1

Student 1	Student 2	Student 3
__On task __Related __Off tsk	__On task __Related __Off tsk	__On task __Related __Off tsk
Student 4	Student 5	Student 6
__On task __Related __Off tsk	__On task __Related __Off tsk	_On task _Related _Off tsk

Time Sample 2

Student 1	Student 2	Student 3
__On task __Related __Off tsk	__On task __Related __Off tsk	__On task __Related __Off tsk
Student 4	Student 5	Student 6
__On task __Related __Off tsk	__On task __Related __Off tsk	_On task _Related _Off tsk

Time Sample 3

Student 1

__On task
__Related
__Off tsk

Student 2

__On task
__Related
__Off tsk

Student 3

__On task
__Related
__Off tsk

Student 4

__On task
__Related
__Off tsk

Student 5

__On task
__Related
__Off tsk

Student 6

_On task
_Related
_Off tsk

Time Sample 4

Student 1

__On task
__Related
__Off tsk

Student 2

__On task
__Related
__Off tsk

Student 3

__On task
__Related
__Off tsk

Student 4

__On task
__Related
__Off tsk

Student 5

__On task
__Related
__Off tsk

Student 6

_On task
_Related
_Off tsk

Time Sample 5

Student 1

__On task
__Related
__Off tsk

Student 2

__On task
__Related
__Off tsk

Student 3

__On task
__Related
__Off tsk

Student 4

__On task
__Related
__Off tsk

Student 5

__On task
__Related
__Off tsk

Student 6

_On task
_Related
_Off tsk

Time Sample 6

Student 1

__On task
__Related
__Off tsk

Student 2

__On task
__Related
__Off tsk

Student 3

__On task
__Related
__Off tsk

Student 4

__On task
__Related
__Off tsk

Student 5

__On task
__Related
__Off tsk

Student 6

_On task
_Related
_Off tsk

Time Sample 7

Student 1

__On task
__Related
__Off tsk

Student 2

__On task
__Related
__Off tsk

Student 3

__On task
__Related
__Off tsk

Student 4

__On task
__Related
__Off tsk

Student 5

__On task
__Related
__Off tsk

Student 6

_On task
_Related
_Off tsk

Time Sample 8

Student 1

__On task
__Related
__Off tsk

Student 2

__On task
__Related
__Off tsk

Student 3

__On task
__Related
__Off tsk

Student 4

__On task
__Related
__Off tsk

Student 5

__On task
__Related
__Off tsk

Student 6

_On task
_Related
_Off tsk

Time Sample 9

Student 1	Student 2	Student 3
__On task __Related __Off tsk	__On task __Related __Off tsk	__On task __Related __Off tsk
Student 4	Student 5	Student 6
__On task __Related __Off tsk	__On task __Related __Off tsk	_On task _Related _Off tsk

Time Sample 10

Student 1	Student 2	Student 3
__On task __Related __Off tsk	__On task __Related __Off tsk	__On task __Related __Off tsk
Student 4	Student 5	Student 6
__On task __Related __Off tsk	__On task __Related __Off tsk	_On task _Related _Off tsk

Success level:

Student 1______________
Student 2______________
Student 3______________
Student 4_____________
Student 5_____________
Student 6_____________

Comments:

Student 1:
Student 2:
Student 3:
Student 4:
Student 5:
Student 6:

Appendix D

Descriptive Survey and Attitudes Toward Mainstreaming Scale

DEVELOPMENT OF THE ATTITUDES TOWARD MAINSTREAMING SCALE

The purpose of the Attitudes Toward Mainstreaming Scale (ATMS) is to provide a measure of a regular education teacher's attitudes toward mainstreaming and handicapped students. It supplements the Stages of Concern scale, as modified by our project, in determining if a need exists for training to change attitudes. We began the development of the ATMS by reviewing existing attitude scales, particularly the scale used by Larrivee and Cook (1979). Following this review, we collected and formulated 10 items for an initial test. This test involved 53 regular education teachers who responded to the 10 items in a paper and pencil format.

The first item in this Appendix is a hard copy of the screen displays for the Descriptive Survey and ATMS. Following this, we have a copy of the 10 original items, along with a statistical breakdown of the responses to the ten items, the means and standard deviations, intercorrelations, and a factor analysis. Six of the 10 items were selected for inclusion in the final form of the ATMS. Four items were discarded because of low correlations with other items, low standard deviations, and/or poor loading into any of the factors.

```
   You are about to complete the "Stages of Concern
   about Mainstreaming" questionnaire. This questionnaire
   was developed by The Institute for Study of Except-
   ional Children and Youth of the University of
   Maryland. It is modified from the original
   "Stages of Concern" questionnaire developed
   by Dr. Gene Hall and his colleagues of the University of
   Texas at Austin.

   First, please respond to the questions that
   follow which describe your current role and status
   as an educator.

   Type F "enter" to move to the next page.

--------------------------------------------------------------------------------
C  CHANGES RATING       ¦   S  STARTS PROGRAM          ¦  F  PAGES FORWARD
                        ¦   D  GETS DIRECTIONS         ¦  B  PAGES BACK
```

```
      Enter the number (followed by the "enter" key)
      of the response that best describes you.


    1. Sex :                   2. Age :

       Male   (1)            20-25 : (1)
       Female (2)            26-30 : (2)
                             31-35 : (3)
                             36-40 : (4)
                             41-45 : (5)
                             46-50 : (6)
                             51-55 : (7)
                             56 or above : (8)

--------------------------------------------------------------------------------
C  CHANGES RATING       ¦   S  STARTS PROGRAM          ¦  F  PAGES FORWARD
                        ¦   D  GETS DIRECTIONS         ¦  B  PAGES BACK
```

```
     Enter the number (followed by the "enter" key)
     of the response that best describes you.


   3. Current role :        4. Current level :

   (1) Regular Teacher                (1) Preschool
   (2) Special Education Teacher      (2) Primary (K_3)
   (3) Administrator or Supervisor    (3) Intermediate (4_6)
   (4) Other                          (4) Middle-Junior High (6_9)
                                      (5) Senior High (9_12)
                                      (6) K-12








--------------------------------------------------------------------------
C  CHANGES RATING       |  S  STARTS PROGRAM          |  F  PAGES FORWARD
                        |  D  GETS DIRECTIONS         |  B  PAGES BACK
```

```
   5. Years of experience in current role :

   6. Total years of experience in education :

   7. What training have you had in special education?:

   (1) None
   (2) One course or workshop
   (3) Two to four courses or workshops
   (4) More than four courses or workshops
   (5) Certification or degree in special education




--------------------------------------------------------------------------
C  CHANGES RATING       |  S  STARTS PROGRAM          |  F  PAGES FORWARD
                        |  D  GETS DIRECTIONS         |  B  PAGES BACK
```

```
      Enter the number (followed by the "enter" key)
      of the response that best describes you.

 8. Experience teaching special education students :

    (1) Very little or no experience
    (2) Regular classes with a few mainstreamed special education students
    (3) Teaching many mainstreamed special education students
    (4) Special education teacher
    (5) Other
```

```
--------------------------------------------------------------------------------
C  CHANGES RATING       !   S  STARTS PROGRAM          !  F  PAGES FORWARD
                        !   D  GETS DIRECTIONS         !  B  PAGES BACK
```

```
             On the next page you will be asked to
             rate six items about mainstreaming on
             a scale of one through five.
```

```
--------------------------------------------------------------------------------
C  CHANGES RATING       !   S  STARTS PROGRAM          !  F  PAGES FORWARD
                        !   D  GETS DIRECTIONS         !  B  PAGES BACK
```

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

1. In my opinion, mainstreaming is inappropriate when class size is medium to large. ---

2. I believe that special education students have the ability to participate appropriately in regular classes. ---

3. I think that mainstreaming benefits the teaching and learning processes of the regular classroom. ---

4. I think that special education students should be mainstreamed only in basic skills classes. ---

5. Regular teachers generally possess the expertise for effectively teaching mainstreamed students. ---

6. The behavior of mainstreamed students too often sets a bad example for regular students. ---

INITIAL SURVEY WITH 10 ITEMS

Are you certified to teach special education? yes or no (please circle)

What is the level of your current assignment? elementary or secondary or K-12 (please circle)

Please rate the following items on a 1 to 5 scale.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

1. In my opinion, mainstreaming is inappropriate when class size is medium to large. __________

2. I believe that special education students have the ability to participate appropriately in regular classes. __________

3. I think that mainstreaming benefits the teaching and learning processes of the regular classroom. __________

4. I think that special education students should be mainstreamed only in basic skills classes. __________

5. I believe that grading is not fair in classes where there are mainstreamed students. __________

6. The presence of mainstreamed students will promote acceptance of differences on the part of regular students. __________

7. Mainstreamed students are likely to develop academic skills more quickly in a special education class than in a regular class. __________

8. Regular teachers generally possess the expertise for effectively teaching mainstreamed students. __________

9. The behavior of mainstreamed students too often sets a bad example for regular students. __________

10. Mainstreaming special education students promotes the special education student's social independence. __________

STATISTICAL ANALYSIS OF ATMS ITEMS

(with reversals on questions: 1, 4, 5, 7, 9)

```
The raw data or transformation pass is proceeding
     53 cases are written to the uncompressed active file.

***** Memory allows a total of  14735 Values, accumulated across all Variables.
      There also may be up to     1842 Value Labels for each Variable.

------------------------------------------------------------------------------
Page   30                          SPSS/PC+                          10/8/85

I1

                                                           Valid      Cum
 Value Label                 Value  Frequency  Percent   Percent   Percent

                              1.00          2      3.8       3.8       3.8
                              2.00         20     37.7      37.7      41.5
                              3.00          8     15.1      15.1      56.6
                              4.00         22     41.5      41.5      98.1
                              5.00          1      1.9       1.9     100.0
                                      -------  -------   -------
                             TOTAL         53    100.0     100.0

Valid Cases       53      Missing Cases      0

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

I2

                                                           Valid      Cum
 Value Label                 Value  Frequency  Percent   Percent   Percent

                              2.00         10     18.9      18.9      18.9
                              3.00         11     20.8      20.8      39.6
                              4.00         26     49.1      49.1      88.7
                              5.00          6     11.3      11.3     100.0
                                      -------  -------   -------
                             TOTAL         53    100.0     100.0

Valid Cases       53      Missing Cases      0

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

I3

                                                           Valid      Cum
 Value Label                 Value  Frequency  Percent   Percent   Percent

                              2.00         14     26.4      26.4      26.4
                              3.00         12     22.6      22.6      49.1
                              4.00         21     39.6      39.6      88.7
                              5.00          6     11.3      11.3     100.0
                                      -------  -------   -------
                             TOTAL         53    100.0     100.0

Valid Cases       53      Missing Cases      0
------------------------------------------------------------------------------
Page   31                          SPSS/PC+                          10/8/85
```

```
                                                         Valid     Cum
 Value Label                   Value  Frequency  Percent  Percent  Percent

                                1.00          3      5.7      5.7      5.7
                                2.00          5      9.4      9.4     15.1
                                3.00          7     13.2     13.2     28.3
                                4.00         24     45.3     45.3     73.6
                                5.00         14     26.4     26.4    100.0
                                         -------  -------  -------
                               TOTAL         53    100.0    100.0

Valid Cases      53      Missing Cases      0

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

5

                                                         Valid     Cum
 Value Label                   Value  Frequency  Percent  Percent  Percent

                                0.0           1      1.9      1.9      1.9
                                1.00          1      1.9      1.9      3.8
                                2.00          7     13.2     13.2     17.0
                                3.00         13     24.5     24.5     41.5
                                4.00         27     50.9     50.9     92.5
                                5.00          4      7.5      7.5    100.0
                                         -------  -------  -------
                               TOTAL         53    100.0    100.0

alid Cases      53      Missing Cases      0

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

6

                                                         Valid     Cum
 Value Label                   Value  Frequency  Percent  Percent  Percent

                                2.00          4      7.5      7.5      7.5
                                3.00          7     13.2     13.2     20.8
                                4.00         24     45.3     45.3     66.0
                                5.00         18     34.0     34.0    100.0
                                         -------  -------  -------
                               TOTAL         53    100.0    100.0

Valid Cases      53      Missing Cases      0
------------------------------------------------------------------------------
age  32                          SPSS/PC+                             10/8/85

I7

                                                         Valid     Cum
 Value Label                   Value  Frequency  Percent  Percent  Percent

                                1.00          3      5.7      5.7      5.7
                                2.00         11     20.8     20.8     26.4
                                3.00         25     47.2     47.2     73.6
                                4.00          9     17.0     17.0     90.6
                                5.00          5      9.4      9.4    100.0
                                         -------  -------  -------
                               TOTAL         53    100.0    100.0
```

```
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

8

                                                             Valid      Cum
 Value Label                     Value  Frequency  Percent  Percent  Percent

                                  1.00          9     17.0     17.0     17.0
                                  2.00         26     49.1     49.1     66.0
                                  3.00          8     15.1     15.1     81.1
                                  4.00          9     17.0     17.0     98.1
                                  5.00          1      1.9      1.9    100.0
                                          -------  -------  -------
                                 TOTAL         53    100.0    100.0

alid Cases       53      Missing Cases      0

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

I9

                                                             Valid      Cum
 Value Label                     Value  Frequency  Percent  Percent  Percent

                                  1.00          3      5.7      5.7      5.7
                                  2.00          8     15.1     15.1     20.8
                                  3.00         11     20.8     20.8     41.5
                                  4.00         25     47.2     47.2     88.7
                                  5.00          6     11.3     11.3    100.0
                                          -------  -------  -------
                                 TOTAL         53    100.0    100.0

Valid Cases       53      Missing Cases      0
--------------------------------------------------------------------------------
age  33                         SPSS/PC+                               10/8/85

I10

                                                             Valid      Cum
 Value Label                     Value  Frequency  Percent  Percent  Percent

                                  2.00          2      3.8      3.8      3.8
                                  3.00          8     15.1     15.1     18.9
                                  4.00         30     56.6     56.6     75.5
                                  5.00         13     24.5     24.5    100.0
                                          -------  -------  -------
                                 TOTAL         53    100.0    100.0

alid Cases       53      Missing Cases      0
--------------------------------------------------------------------------------
age  34                         SPSS/PC+                               10/8/85

This procedure was completed at 16:55:16
--------------------------------------------------------------------------------
age  35                         SPSS/PC+                               10/8/85

Variable      Cases            Mean         Std Dev

I1              53           3.0000          1.0190
I2              53           3.5283           .9324
I3              53           3.3585          1.0018
```

```
6              53          4.0566             .8861
I7             53          3.0377             .9993
I8             53          2.3774            1.0233
9              53          3.4340            1.0654
10             53          4.0189             .7465
------------------------------------------------------------------------------
age  36                         SPSS/PC+                              10/8/85

Correlations:   I1          I2          I3          I4          I5          I6

  I1          1.0000       .1012      .3956*      .1516       .1121      .3833*
  I2           .1012      1.0000      .5139**     .3560*     -.0235      .3122
  I3           .3956*      .5139**   1.0000       .3307*      .0904      .1717
  I4           .1516       .3560*     .3307*     1.0000       .1905      .2456
  I5           .1121      -.0235      .0904       .1905      1.0000     -.1140
  I6           .3833*      .3122      .1717       .2456      -.1140     1.0000
  I7           .2077       .1846      .1591       .3513*      .2693      .1496
  I8          -.0184       .3715*     .1656       .3611*      .0432      .1881
  I9           .4428**     .1326      .3920*      .1483       .1076      .1568
  I10          .1769       .2617      .2479       .2121      -.1386      .3763*

 of cases:     53          1-tailed Signif:  * - .01   ** - .001

 . " is printed if a coefficient cannot be computed
------------------------------------------------------------------------------
Page  37                        SPSS/PC+                              10/8/85

orrelations:   I7          I8          I9          I10

  I1           .2077      -.0184      .4428**     .1769
  I2           .1846       .3715*     .1326       .2617
  I3           .1591       .1656      .3920*      .2479
  I4           .3513*      .3611*     .1483       .2121
  I5           .2693       .0432      .1076      -.1386
  I6           .1496       .1881      .1568       .3763*
  I7          1.0000      -.0706      .2011       .1021
  I8          -.0706      1.0000      .0233       .2926
  I9           .2011       .0233     1.0000       .2555
  I10          .1021       .2926      .2555      1.0000

 of cases:     53          1-tailed Signif:  * - .01   ** - .001

" . " is printed if a coefficient cannot be computed
------------------------------------------------------------------------------
age  38                         SPSS/PC+                              10/8/85

his procedure was completed at 16:58:31

***** Given WORKSPACE allows for  9005 Cells with  1 Dimensions for MEANS.


------------------------------------------------------------------------------
Page  39                        SPSS/PC+                              10/8/85

ummaries of    I1
By levels of   SCHLEV

ariable       Value  Label                    Mean      Std Dev     Cases

For Entire Population                         3.0000     1.0190        53

CHLEV        ele                              2.9231     1.0554        26
SCHLEV        k12                             3.3333      .5774         3
SCHLEV        sec                             3.0417     1.0417        24
```

```
------------------------------------------------------------------------------
age  40                        SPSS/PC+                              10/8/85

Summaries of    I2
y levels of    SCHLEV

Variable        Value  Label                     Mean     Std Dev     Cases

For Entire Population                          3.5283       .9324        53

CHLEV      ele                                 3.3462       .9356        26
CHLEV      k12                                 4.3333       .5774         3
SCHLEV     sec                                 3.6250       .9237        24

 Total Cases =        53
------------------------------------------------------------------------------
Page  41                        SPSS/PC+                              10/8/85

Summaries of    I3
By levels of    SCHLEV

ariable        Value  Label                     Mean     Std Dev     Cases

For Entire Population                          3.3585      1.0018        53

SCHLEV     ele                                 3.2692      1.0023        26
SCHLEV     k12                                 3.3333       .5774         3
CHLEV      sec                                 3.4583      1.0624        24

 Total Cases =        53
------------------------------------------------------------------------------
age  42                        SPSS/PC+                              10/8/85

Summaries of    I4
y levels of    SCHLEV

Variable        Value  Label                     Mean     Std Dev     Cases

For Entire Population                          3.7736      1.1205        53

CHLEV      ele                                 3.6538      1.1981        26
CHLEV      k12                                 3.3333      2.0817         3
SCHLEV     sec                                 3.9583       .9079        24

 Total Cases =        53
------------------------------------------------------------------------------
Page  43                        SPSS/PC+                              10/8/85

Summaries of    I5
By levels of    SCHLEV

ariable        Value  Label                     Mean     Std Dev     Cases

For Entire Population                          3.4340      1.0097        53

SCHLEV     ele                                 3.1923      1.0590        26
SCHLEV     k12                                 4.0000      1.0000         3
CHLEV      sec                                 3.6250       .9237        24

 Total Cases =        53
------------------------------------------------------------------------------
age  44                        SPSS/PC+                              10/8/85

Summaries of    I6
```

```
ariable       Value  Label                        Mean     Std Dev    Cases

For Entire Population                            4.0566      .8861       53

CHLEV     ele                                    4.1154      .7656       26
SCHLEV    k12                                    4.0000     1.0000        3
CHLEV     sec                                    4.0000     1.0215       24

  Total Cases =      53
---------------------------------------------------------------------------
age  45                         SPSS/PC+                          10/8/85

Summaries of    I7
y levels of    SCHLEV

Variable      Value  Label                        Mean     Std Dev    Cases

or Entire Population                             3.0377      .9993       53

SCHLEV    ele                                    2.7308     1.0023       26
CHLEV     k12                                    3.0000     0.0           3
SCHLEV    sec                                    3.3750      .9696       24

  Total Cases =      53
---------------------------------------------------------------------------
Page  46                        SPSS/PC+                          10/8/85

ummaries of    I8
By levels of    SCHLEV

ariable       Value  Label                        Mean     Std Dev    Cases

For Entire Population                            2.3774     1.0233       53

SCHLEV    ele                                    2.5385     1.0670       26
SCHLEV    k12                                    3.0000     1.0000        3
SCHLEV    sec                                    2.1250      .9470       24

  Total Cases =      53
---------------------------------------------------------------------------
age  47                         SPSS/PC+                          10/8/85

Summaries of    I9
y levels of    SCHLEV

Variable      Value  Label                        Mean     Std Dev    Cases

or Entire Population                             3.4340     1.0654       53

SCHLEV    ele                                    3.0769     1.1635       26
CHLEV     k12                                    4.0000     1.0000        3
SCHLEV    sec                                    3.7500      .8470       24

  Total Cases =      53
---------------------------------------------------------------------------
Page  48                        SPSS/PC+                          10/8/85

ummaries of    I10
By levels of    SCHLEV

ariable       Value  Label                        Mean     Std Dev    Cases

For Entire Population                            4.0189      .7465       53
```

```
SCHLEV     k12                                         3.6667      .5774        3
SCHLEV     sec                                         4.1250      .6124       24

  Total Cases =      53
---------------------------------------------------------------------------------
Page  49                          SPSS/PC+                                10/8/85

Summaries of    IT
By levels of    SCHLEV

Variable       Value  Label                              Mean     Std Dev    Cases

For Entire Population                                  3.0547      .3428       53

SCHLEV     ele                                         3.1423      .3443       26
SCHLEV     k12                                         3.0667      .2517        3
SCHLEV     sec                                         2.9583      .3361       24

  Total Cases =      53
---------------------------------------------------------------------------------
Page  50                          SPSS/PC+                                10/8/85

This procedure was completed at 16:59:16

This FACTOR analysis requires      13440 (      13.1K) BYTES of memory.
---------------------------------------------------------------------------------
Page  51                          SPSS/PC+                                10/8/85

               - - - -   F A C T O R   A N A L Y S I S   - - - -

Analysis Number  1  Listwise deletion of cases with missing values

Extraction  1  for Analysis  1, Principal-Components Analysis (PC)

Initial Statistics:

Variable      Communality  *  Factor   Eigenvalue   Pct of Var   Cum Pct
                           *
I1                1.00000  *     1      2.94464       29.4         29.4
I2                1.00000  *     2      1.48633       14.9         44.3
I3                1.00000  *     3      1.30055       13.0         57.3
I4                1.00000  *     4       .94819        9.5         66.8
I5                1.00000  *     5       .81452        8.1         74.9
I6                1.00000  *     6       .72908        7.3         82.2
I7                1.00000  *     7       .57076        5.7         87.9
I8                1.00000  *     8       .49116        4.9         92.9
I9                1.00000  *     9       .42670        4.3         97.1
I10               1.00000  *    10       .28806        2.9        100.0

   PC Extracted    3 factors.

Factor Matrix:

               FACTOR  1     FACTOR  2     FACTOR  3

I1               .56179        .41676       -.44210
I2               .65402       -.33232        .21356
I3               .70200        .09734       -.03485
I4               .62781       -.03769        .48258
I5               .14375        .56842        .55154
I6               .57380       -.21672       -.32924
I7               .42625        .47623        .28970
I8               .42924       -.55954        .36374
I9               .53836        .39707       -.34910
I10              .55558       -.35170       -.27331
```

```
Final Statistics:

Variable      Communality  *  Factor   Eigenvalue   Pct of Var   Cum Pct
                           *
I1                .68475   *     1       2.94464       29.4        29.4
I2                .58378   *     2       1.48633       14.9        44.3
I3                .50349   *     3       1.30055       13.0        57.3
I4                .62845   *
I5                .64796   *
I6                .48462   *
I7                .49241   *
I8                .62964   *
I9                .56937   *
I10               .50705   *
--------------------------------------------------------------------------------
Page  52                         SPSS/PC+                               10/8/85

                 - - - -   F A C T O R   A N A L Y S I S   - - - -

Varimax  Rotation  1,  Extraction  1,  Analysis  1 - Kaiser Normalization.

  Varimax converged in    6 iterations.

Rotated Factor Matrix:

               FACTOR  1     FACTOR  2     FACTOR  3

I1              -.03387        .81873        .11525
I2               .73813        .18525        .06807
I3               .41404        .53820        .20592
I4               .64269        .11428        .44981
I5              -.03694       -.02451        .80374
I6               .40457        .51205       -.24237
I7               .11529        .29510        .62612
I8               .77843       -.14913       -.03812
I9              -.00258        .73742        .15991
I10              .49576        .41273       -.30154


Factor Transformation Matrix:

                FACTOR  1     FACTOR  2     FACTOR  3

FACTOR  1        .69347        .68227        .23153
FACTOR  2       -.61093        .38650        .69093
FACTOR  3        .38191       -.62059        .68485

--------------------------------------------------------------------------------
Page  53                         SPSS/PC+                               10/8/85

This procedure was completed at 17:00:41
```

Appendix E

Stages of Concern Screens

On the next page you will be asked to rate six items about mainstreaming on a scale of one through five.

```
--------------------------------------------------------------------------------
C  CHANGES RATING      ¦   S  STARTS PROGRAM          ¦  F  PAGES FORWARD
                       ¦   D  GETS DIRECTIONS         ¦  B  PAGES BACK
```

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

1. In my opinion, mainstreaming is inappropriate when class size is medium to large. ---

2. I believe that special education students have the ability to participate appropriately in regular classes. ---

3. I think that mainstreaming benefits the teaching and learning processes of the regular classroom. ---

4. I think that special education students should be mainstreamed only in basic skills classes. ---

5. Regular teachers generally possess the expertise for effectively teaching mainstreamed students. ---

6. The behavior of mainstreamed students too often sets a bad example for regular students. ---

CONCERNS QUESTIONNAIRE

The purpose of this questionnaire is to determine the concerns of people who are or may be involved in mainstreaming.

Since the term "mainstreaming" can be interpreted in different ways, we have included the following information. Please read this before completing the questionnaire.

```
-----------------------------------------------------------------------------------
C  CHANGES RATING      |   S  STARTS PROGRAM           |  F  PAGES FORWARD
                       |   D  GETS DIRECTIONS          |  B  PAGES BACK
```

Mainstreaming

Not too long ago, students needing special education services were removed from the "mainstream" of regular education and placed in separate, self-contained special education classes or schools. These students were separated physically, socially, instructionally and administratively from regular programs.

In the 1960`s people began to question this approach. It seemed that many special education students were being unfairly stigmatized and isolated from the general student population, and that these students were unnecessarily restricted in their access to the services and activities available to regular students. Further, and perhaps most suprisingly, the services provided by special education could not be shown to have educational benefits for a large portion of the special education

```
-----------------------------------------------------------------------------------
C  CHANGES RATING      |   S  STARTS PROGRAM           |  F  PAGES FORWARD
                       |   D  GETS DIRECTIONS          |  B  PAGES BACK
```

population. Perhaps the students were "living down" to the expectations of special education.

Thus, for more than a decade there has been a growing trend toward "mainstreaming" special education students into regular programs. Ideally, mainstreaming should have the following characteristics:

1. To the maximimum possible extent, special education students are integrated into regular programs.
   This integration has the following aspects
   a. physical integration: To the maximimum extent, special education students are taught in physical proximity to regular education students. This means that some

```
------------------------------------------------------------------------------
C  CHANGES RATING         ¦    S  STARTS PROGRAM            ¦  F  PAGES FORWARD
                          ¦    D  GETS DIRECTIONS           ¦  B  PAGES BACK
```

special education students who would once have been placed in special classes within regular schools. Some special education students who would once have been placed in in self-contained classes in regular school are now placed in regular classes for some or most or even all of the school day.

   b. social integration: Physical integration permits social interactions to occur between special education students and regular education students. This does not mean that mainstreaming requires teachers to plan structured social interactions between regular and special education students. Nor does it mean that all social interactions must be desirable and pleasant. It simply means that mainstreaming removes some of the school-created barriers that once contributed to an almost total social separation between

```
------------------------------------------------------------------------------
C  CHANGES RATING         ¦    S  STARTS PROGRAM            ¦  F  PAGES FORWARD
                          ¦    D  GETS DIRECTIONS           ¦  B  PAGES BACK
```

regular and special education students.

c. instructional integration: To the maximum possible extent, special education students receive the normal content and methods of instruction from the regular education program. Adaptations are made on an individual basis only to the degree made necessary by the student`s special needs.

d. administrative integration: Mainstreaming is not possible without administrative linkage between regular and special education programs. Special education students are the shared responsibility of regular and special education.

2. A range of levels of special education are available.

```
------------------------------------------------------------------------------
C  CHANGES RATING        |   S  STARTS PROGRAM          |  F  PAGES FORWARD
                         |   D  GETS DIRECTIONS         |  B  PAGES BACK
```

Some people mistakenly believe that mainstreaming requires that all students be removed from special education and placed in regular education. The real trend is to develop a range of alternatives which include older approaches (resource rooms, regular class placement with special aides and supports, etc.).

Anyone associated with today`s schools is aware that mainstreaming is already being implemented. Considerable progress has been made, but few (if any) schools or school systems have perfected the process. Strong evidence suggests that mainstreaming will be an enduring feature of American education.

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------------------------------------------------------------------------------
C  CHANGES RATING        |   S  STARTS PROGRAM          |  F  PAGES FORWARD
                         |   D  GETS DIRECTIONS         |  B  PAGES BACK
```

Instructions for the Questionnaire

Please respond to the following items in terms of your present concerns, or how you feel about your involvement or potential involvement with mainstreaming. Items that represent concerns you do have should be marked on the scale according to the degree of intensity.

7 = the statement is very true of you at this time.
4 = the statement is somewhat true of you at this time.
1 = the statement is not at all true of you at this time.
0 = the statement seems irrelevant to you.

Remember to respond to each item in terms of your present concerns about your involvement or potential involvement in mainstreaming.

```
------------------------------------------------------------------------------
C  CHANGES RATING       ¦   S  STARTS PROGRAM          ¦  F  PAGES FORWARD
                        ¦   D  GETS DIRECTIONS         ¦  B  PAGES BACK
```

```
      0         1         2         3         4         5         6         7

    Irrelevant       Not True Of       Somewhat True                Very True of
                     me now            of me now                     me now

1.  I am concerned about my other students` attitudes
    toward having mainstreamed students in the
    classroom.

2.  I know of some other approaches besides main-
    streaming that would better meet the educational
    needs of all students.

3.  Because of having mainstreamed students in my
    classroom, I am concerned about not having
    enough time to organize myself each day.

4.  I would like to help other teachers to develop
    effective strategies for mainstreaming.

------------------------------------------------------------------------------
C  CHANGES RATING      ¦   NUMBERS (0-7) GIVE RATING   ¦  F  PAGES FORWARD
E   STOPS PROGRAM      ¦   D  GETS DIRECTIONS          ¦  B  PAGES BACK
```

```
       0          1          2          3          4          5          6          7

  Irrelevant       Not True Of        Somewhat True                         Very True of
                   me now             of me now                               me now

5.  I have very limited knowledge about teaching
    mainstreamed students.


6.  I am concerned about changes in my professional
    status caused by teaching mainstreamed students.


7.  I am concerned about the conflict between
    my interests in teaching in general, and my
    responsibilities to teach mainstreamed students.

8.  I am concerned about revising the way I have
    been teaching students in my mainstreamed class-
    room.

-------------------------------------------------------------------------------
C  CHANGES RATING     ¦    NUMBERS (0-7) GIVE RATING     ¦  F  PAGES FORWARD
E   STOPS PROGRAM     ¦    D  GETS DIRECTIONS            ¦  B  PAGES BACK
```

```
       0          1          2          3          4          5          6          7

  Irrelevant       Not True Of        Somewhat True                         Very True of
                   me now             of me now                               me now

9.  I would like to develop working relationships
    with faculty in my school and other schools
    who are teaching mainstreamed students.

10. I am concerned about how my regular students are
    affected by having mainstreamed students in the
    classroom.

11. I would like to know who will make decisions
    about the placement of mainstreamed students
    in my classroom.

12. I would like to discuss approaches to teaching
    a mainstreamed class.

-------------------------------------------------------------------------------
C  CHANGES RATING     ¦    NUMBERS (0-7) GIVE RATING     ¦  F  PAGES FORWARD
E   STOPS PROGRAM     ¦    D  GETS DIRECTIONS            ¦  B  PAGES BACK
```

```
        0         1         2         3         4         5         6         7

    Irrelevant       Not True Of       Somewhat True                Very True of
                     me now            of me now                      me now

13. I would like to know what resources would be
    available to me for teaching mainstreamed
    students in my classroom.

14. I am concerned about my inability to manage
    all that teaching mainstreamed students requires.


15. I would like to know how my teaching is supposed
    to change when I have mainstreamed students in
    my class.

16.I would like to familiarize others with the
    progress of mainstreaming.


-------------------------------------------------------------------------------
C  CHANGES RATING    ¦    NUMBERS (0-7) GIVE RATING    ¦  F  PAGES FORWARD
E   STOPS PROGRAM    ¦    D  GETS DIRECTIONS           ¦  B  PAGES BACK
```

```
        0         1         2         3         4         5         6         7

    Irrelevant       Not True Of       Somewhat True                Very True of
                     me now            of me now                      me now

17. I am concerned about evaluating my effectiveness
    as a teacher of class containing some mainstreamed
    students.

18. I would like to revise the instructional approach
    to mainstreaming.


19. I would like to modify our approach to main-
    streaming based on the experiences of my
    students.

20. I would like to promote a positive attitude
    among my students about having mainstreamed
    students in class.

-------------------------------------------------------------------------------
C  CHANGES RATING    ¦    NUMBERS (0-7) GIVE RATING    ¦  F  PAGES FORWARD
E   STOPS PROGRAM    ¦    D  GETS DIRECTIONS           ¦  B  PAGES BACK
```

```
       0          1          2          3          4          5          6          7

    Irrelevant       Not True Of        Somewhat True                         Very True of
                     me now             of me now                              me now

21. I am concerned about time spent working with
    non-academic problems related to teaching
    mainstreamed students.

22. I would like to know what other changes in
    teaching mainstreamed students might be taking
    place in near future.

23. I would like to coordinate my efforts with
    others to maximize the benefits of main-
    streaming.

24. I would like to have more information on expected
    time and energy commitments required by the
    presence of mainstreamed students in my classroom.

--------------------------------------------------------------------------------
C  CHANGES RATING    |    NUMBERS (0-7) GIVE RATING    |  F  PAGES FORWARD
E   STOPS PROGRAM    |    D  GETS DIRECTIONS           |  B  PAGES BACK
```

```
       0          1          2          3          4          5          6          7

    Irrelevant       Not True Of        Somewhat True                         Very True of
                     me now             of me now                              me now

25. I would like to know what other faculty are doing
    regarding mainstreaming.

26. I would like to determine how to supplement,
    enhance or replace the approaches we currently
    use for mainstreaming.

27. I would like to use feedback from students
    to improve the implementation of mainstreaming.

28. I am concerned about changes in my role due to
    the placement of mainstreamed students in my
    classroom.

--------------------------------------------------------------------------------
C  CHANGES RATING    |    NUMBERS (0-7) GIVE RATING    |  F  PAGES FORWARD
E   STOPS PROGRAM    |    D  GETS DIRECTIONS           |  B  PAGES BACK
```

0	1	2	3	4	5	6	7
Irrelevant	Not True Of me now		Somewhat True of me now			Very True of me now	

29. In my opinion, the coordination of tasks and people required by mainstreaming is taking too much of my time.

30. I would like to know the rationale for mainstreaming.

C CHANGES RATING	NUMBERS (0-7) GIVE RATING	F PAGES FORWARD
E STOPS PROGRAM	D GETS DIRECTIONS	B PAGES BACK

Appendix F

Technical Report #201

Adapting the Stages of Concern About Innovation Questionnaire to Measure Teacher Attitudes About Mainstreaming

TECHNICAL REPORT #201

Adapting the Stages of Concern About Innovation Questionnaire to Measure Teacher Attitudes About Mainstreaming

Doug Coulson
David B. Malouf
Jacqueline A. Haynes

February, 1985

Special Project: Microcomputer-Assisted Needs Assessment System for Teacher Training in Special Education

David Malouf, Director

Institute for the Study of Exceptional Children and Youth
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Abstract

This study examined the statistical properties of the Stages of Concern About Innovation Questionnaire (SoC) as adapted for measuring regular teachers' concerns about the innovation "mainstreaming." This paper reports on the internal consistency of the SoC scale and describes an item analysis based on data collected from 40 teachers during the summer of 1984. The results of this study are being used in the development of a computer program for delivering and scoring the SoC.

The general focus of this project is the development of a computer-based needs assessment system to select teacher training experiences for regular educators working with mainstreamed handicapped students. This system, termed SNAP (Systematic Needs Assessment Program), will use several types of data and data collection procedures which include both cognitive and affective outcomes. This study examines one affective measure.

Affective factors are considered critical in the selection of teacher training experiences. To this end several methods of attitude assessment were considered. Observational work was considered to be too cumbersome to use in the system. On the other hand a unidimensional attitude scale was considered to be too narrow in its focus. Also, an attitude scale dealing singly with the handicapped or mainstreaming distorted the efforts of the project in the sense that it focused attention on the mainstreamed student rather than on effectively teaching in the mainstreamed environment. For example, the "Attitude Toward Disabled Person Scale" developed by Yuker, Block, and Young (1970) consists of simple declarative statements about disabled persons to which the respondent answers true or false.

The assessment method finally chosen was the SoC Questionnaire developed by Gene Hall and his colleagues at the University of Texas, Austin. This questionnaire deals with concerns rather than attitudes. The concept of concern is broader than that of attitude. Traditionally attitude is measured by locating an individual on a bipolar evaluative dimension (e.g., good - bad) relative to some object. In contrast, concern deals with the composite representation of feelings, preoccupation, thought, and consideration given to a particular issue or task (Hall, George & Rutherford, 1979). By examining concerns rather than attitudes, a broader based entry point is achieved. Furthermore, the SoC as developed by Hall et al., contains seven subscales which form a logical developmental sequence of concerns. These subscales are:

1. Awareness: Little concern about or involvement with the innovation is indicated.

2. Information: A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about himself/herself in relation to the innovation. She/he is interested, in a selfless manner, in substantive aspects of the innovation such as its general characteristics, effects, and use requirements.

3. Personal: The individual is uncertain about the demands of the innovation, his/her adequacy to meet the demands, and his/her role in the innovation.

4. Management: Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost.

5. Consequence: Attention focuses on the impact of the innovation on students in the individuals immediate sphere of influence. The focus is on the relevance of the innovation for students, including performance and competencies, and changes needed to increase outcomes.

6. Collaboration: The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative.

7. Refocusing: The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative.

These subscales permit appropriate branching of users into subsequent activities such as training options. For example, someone expressing concerns about "information" on mainstreaming would receive a different set of suggested activities than someone expressing concerns about "collaboration" on mainstreaming.

Pilot Study

Introduction

The SoC questionnaire developed by Hall et al., was not entirely appropriate in its original form for measuring concerns about mainstreaming. The major difference is that mainstreaming is mandated by law whereas "innovations" (original SoC scale) are not. Thus, questions such as: "I would like to discuss the possibility of using the innovation" were not appropriate.

Question revision was undertaken by a panel of three researchers. Each researcher independently revised the 35 items to reflect the mandatory nature of mainstreaming. A group session was conducted to merge the revisions and rewrite the items. A sample revision is given below:

Item: I would like to discuss the possibility of using the innovation.

Revision: I would like to discuss approaches to teaching a mainstreamed class.

A comparison of the changes is given in Appendix A. Appendix B contains the final version of the SoC questionnaire, including the introduction and instructions.

Sample

Participants in the pilot study were teachers and several administrators who were involved in a professional workshop in Howard County and a class at the University of Maryland during the summer of 1984. Those involved in the workshop and class were asked to fill out the SoC questionnaire, and all agreed to do so. This resulted in a sample of convenience of 40.

Procedure

The participants filled out the seven page questionnaire during workshop or class time. Page 1 contained descriptive questions regarding gender, age, and experience. The next two pages presented our definition of mainstreaming, followed by the 35 questions of the modified SoC. Participants took about 20 minutes to complete the questionniare.

Results

Descriptive information about the sample is presented in Tables 1 through 5. The sample was slightly more than 80% female. The females were more evenly distributed across grade level than the males, of whom 67% were from the high school level; 26% of the females were from the elementary level and none at the elementary level were male. 86% of the males in the sample were regular teachers whereas 55% of the females were regular teachers.

More than half of the sample had very little training in special education (see Table 4). Only 10% of the 40 participants were certified or had a degree in special education. Table 5 reflects similar information and shows that a full 42.5% of the sample had little or no experience with the mainstreamed classroomm.

Reliability statistics are presented in Tables 6 through 8. Table 6 gives the Alpha coefficients for the overall scale consisting of all 35 items and each of the seven subscales. Note that each subscale consists of five items. The item analysis consists of item - total score correlations and these correlation coefficients are listed in Table 7. Finally, Table 8 contains the intercorrelations among the seven subscales.

Discussion

The reliability data yield a clear pattern of results for this particular sample. Throughout Tables 6, 7, and 8 the Awareness subscale shows up as relatively less reliable and less discriminating than the other six subscales.

In Table 6 the Awareness subscale has the lowest Alpha coefficient. Its coefficient is substantially less in magnitude than five of the other subscales and somewhat less than the Information subscale. Cronbach's Alpha is an internal consistency measure of reliability and thus a low coefficient is indicative of poor intercorrelations among the items of the subscale. Also, it is important to note that the overall reliability of the SoC was excellent (Alpha = .84).

The results in Table 7 support the findings on the reliability coefficients. That is, five of the six items with the lowest item - total score correlation are from the Awareness subscale. Items 31 to 35 constitute the Awareness subscale and all the correlations are low. In addition to these low correlations, a logical analysis of the items revealed that the double clause structure of item 34 (Awareness subscale) created ambiguity.

An overview of Table 8 shows that the Awareness subscale has generally low and negative correlations with the other subscales. While low correlation among subscales is considered a desirable property, these low correlations in conjunction with the results reported in Tables 6 and 7 cast doubt on the usefulness of the Awareness subscale in this research context.

Indeed the very nature of the "innovation" of mainstreaming makes the Awareness subscale somewhat irrelevant. Mainstreaming is mandated by law and therefore teachers must be involved in it. Thus, it really is not reasonable to expect that a teacher would not be aware of mainstreaming. For these reasons it was decided to omit the Awareness subscale from further application within the context of this research project.

In the interpretation of these reliability data there are two cautions. First, a sample of convenience was used and it is therefore inappropriate to generalize these results to a target population. Second, this reliability analysis has been conducted on a published scale which has already gone through a development phase in which the scale was created from a larger pool of items. To the extent that statistical procedures are normative, as they must be, the consequences of a "second level" reliability analysis are likely to show some items as poor. Nonetheless there are strong empirical (normative) and logical grounds for discarding the Awareness subscale, but using the remaining scales in our application.

Table 1

Sex by level

(Count Row % Col.%	Primary	Inter-mediate	Middle-Junior H	Senior High	K-12	Row Total
Male	----	1.0	1.0	4.0	---	6.0
	----	16.7	16.7	66.7	---	18.2
	----	20.0	11.1	36.4	---	
Female	7.0	4.0	8.0	7.0	1.0	27.0
	25.9	14.8	29.6	25.9	3.7	81.8
	100.0	80.0	88.9	63.6	100.0	
Column Total	7.0	5.0	9.0	11.0	1.0	33.0
	21.2	15.2	27.3	33.3	3.0	100.0

Number of missing observations = 7

Table 2
Sex by Current Role

Count Row % Col %	Regular Teacher	Administrator or Supervisor	Other	Row Total
Male	6	1		7
	85.7	14.3		18.4
	26.1	33.3		
Female	17	2	12	31
	54.8	6.5	38.7	81.6
	73.9	66.7	100.0	
Column Total	23	3	12	38
	60.5	7.9	31.6	100.0

Number of missing observations = 2

Table 3
Current level by Current Role

(Count Row % Col.%	Primary	Inter-mediate	Middle-Junior H	Senior High	K-12	Row Total
Regular Teacher	4	3	8	6		21
	19.0	14.3	38.1	28.6		65.6
	57.1	60.0	100.0	54.5		
Administrator or Supervisor				3		3
				100.0		9.4
				27.3		
Other	3	2		2	1	8
	37.5	25.0		25.0	12.5	25.0
	42.9	40.0		18.2	100.0	
Column Total	7	5	8	11	1	32
	21.9	15.6	25.0	34.4	3.1	100.0

Number of missing observations = 8

Table 4

Training in Special Education

	Frequency	Percent
none	14	35.0
one course or workshop	11	27.5
two to four courses or workshops	9	22.5
more than four courses or workshops	2	5.0
certification or degree in special education	4	10.0
TOTAL	40	100.0

Table 5
Special Education Teaching Experience

	Frequency	Percent
very little or no experience	17	42.5
regular classes with a few mainstreamed special education students	14	35.0
teaching many mainstreamed special education students	7	17.5
special education teacher	2	5.0
TOTAL	40	100.0

Table 6

Subscale Relability Coefficients (Alpha)

	N	Alpha
Overall scale	35	.84
Awareness subscale	5	.44
Information subscale	5	.52
Personal subscale	5	.85
Management subscale	5	.70
Consequences subscale	5	.65
Collaboration subscale	5	.83
Refocusing subscale	5	.77

Table 7

Item Total Score Correlations

Item	Total Score	Item	Total Score
1	.42	19	.66**
2	.57**	20	.39
3	.40	21	.68**
4	.30	22	.58**
5	-.04	23	.37
6	.55**	24	.70**
7	.50*	25	.39
8	.65**	26	.41*
9	.51*	27	.48*
10	.46*	28	.70**
11	.57**	29	.53**
12	.32	30	.26
13	.37	31	.11
14	.32	32	-.11
15	.51*	33	.15
16	.39	34	-.17
17	.52	35	-.09
18	.61**		

Minimum pairwise N of cases: = 32
Significance: *-.01 **-.001

Table 8
Subscale Intercorrelations

Correlations	Awar	Info	Pers	Mana	Cons	Coll	Refo
Awareness	1.0**	-.13	-.02	.06	-.28	-.24	-.25
Information	-.13	1.0**	.51**	.14	.34	.01	.08
Personal	-.15	.51**	1.0**	.69**	.48*	.07	.42*
Management	.06	.14	.69**	1.0**	.31	.25	.63**
Consequences	-.28	.34	.48*	.31	1.0**	.35	.57**
Collaboration	-.24	.01	.07	.25	.35	1.0**	.55**
Refocusing	-.25	.08	.42*	.63**	.57**	.55**	1.0**

Minimum pairwise N of cases = 34
Significance: *-.01 **-.001

Appendix A of Technical Report #201

Revised SoC Statements

Figure 1
Revised SoC Statements
(Original SoC Statements are First)

Item Number	Statement
	Stage 0 Awareness
3	I don't even know what the innovation is. I don't know anything about handicapped students being being taught in regular classes. I didn't know that special need children had been mixed into regular classes. I don't know anything about teaching handicapped students.
12	I am not concerned about this innovation I am not concerned about handicapped students being taught in regular classes. The placement of handicapped children into regular classes is something that does not concern me (that does not affect my work (teaching)). I'm not interested in teaching handicapped students.
21	I am completely occupied with other things. I am completely occupied with other things than teaching handicapped students in regular classes. I am completely occupied with other things and am not concerned about the placement of handicapped children in the regular classroom. I'm too busy already to be concerned with teaching handicapped students.
23	Although I don't know about this innovation, I am concerned about things in the area. Although I don't know about teaching handicapped students in regular classes, I am concerned about the quality of education for handicapped students. Although I am not aware of (have not experienced) the placement of handicapped children in regular classrooms, I am concerned about these children. Although I don't know anything about teaching handicapped students, I am concerned about issues related to teaching the handicapped in regular classrooms.
30	At this time, I am not interested in learning about this innovation. At this time,I am not interested in learning about teaching handicapped students in regular classes. At this time, I am not interested in learning about educating special needs children in the regular classroom. At this time, I have no interest in learning about teaching handicapped students in my classroom.
	Stage 1 Informational
6	I have very limited knowledge about the innovation I have very limited knowledge about teaching handicapped students in regular classes. I have very limited knowledge of strategies, skills, innovations for dealing with special needs children in a regular class. (about dealing with special needs children in a regular class.)

Item Number	Statement
	Stage 1 Informational (cont'd)
6 (cont'd)	I know very little about teaching handicapped students.
14	I would like to discuss the possibility of using the innovation.
	I would like to learn more about teaching handicapped students in regular classes.
	Not appropriate
	I would be interested in discussing approaches to teaching handicapped students in my classroom.
15	I would like to know what resources are available if we decide to adopt this innovation.
	I would like to know what resources are available to support teaching handicapped students in regular classes.
	I would like to know what resources are available for helping special needs children in regular classes. Also resources available for teachers.
	I would like to know what resources would be available to me for teaching handicapped students in my classroom.
26	I would like to know what the use of the innovation will require in the immediate future.
	I would like to know what is really required to teach handicapped students in regular classes.
	I would like to know what additional resources may become available in the immediate future for educating handicapped children in the regular classroom. Terms: handicapped vs special needs.
	I would like to know what changes in teaching handicapped students might be taking place in the near future.
35	I would like to know the reasons for teaching handicapped students in regular classes.
	I would like to know how this innovation is better than what we have now.
	I would like to know how placing special needs children in a regular class is better than attending to their needs in separate, self-contained classrooms.
	I would like to know why it is considered preferable to teach handicapped students in mainstreamed classrooms.
X	I would like to learn methods for teaching handicapped students in regular classes.
	I would like to know how to get information about teaching handicapped students in regular classes.
	Stage 2 Personal
7	I would like to know the effect of reorganization on mu professional status.
	I am concerned about changes in my professional status caused by teaching handicapped students in regular classes.
	I would like to know what effect it will have on my role as a regular education teacher to have handicapped students in my class.
	I would like to know the effect of placing handicapped children in my class on my prefessional status.

Item Number	Statement
	Stage 2 Personal (cont'd)
13	I would like to know who will make the decisions in the new system. I am concerned about who makes the decisions when handicapped students are taught in regular classes. I would like to know who will be making decisions about teaching handicapped students in my class. I would like to know who will make decisions about the placement of handicapped children in the regular classrooms.
17	I would like to know how my teaching or administration is supposed to change. I am concerned about changes I am supposed to make in my teaching or administration because handicapped students are being taught in regular chasses. I would like to know how my teaching is supposed to change when I have handicapped students in my class. I would like to know how my teaching or administration is supposed to change when there are special needs children in my classroom.
28	I would like to have more information on time and energy commitments required by this innovation. I am concerned about the time and energy commitments required by teaching handicapped students in regular classes. I would like to have more information on expected time and energy commitments required by the presence of special needs children in my classroom.
33	I would like to know how my role will change when I am using the innovation. I am concerned about changes in my role when handicapped students are taught in regular classes. I would like to know about the changes in my role when teaching classes that contain handicapped children. Move away from future tense. I would like to know how my role will change when I have handicapped students in my classroom.
	Stage 3 Management
4	I am concerned about not having enough time to organize myself each day. Because of mainstreaming, I am concerned about not having enough time to organize myself each day. Orient question to mainstreamin I am concerned about not having enough time to organize myself each day, because of mainstreaming.
8	I am concerned about conflict between my interests and my responsibilities. Difficult to apply. I am concerned about the conflict between my interests in teaching in general, and my responsibilities to teadh handicapped children.

Item Number	Statement
	Stage 3 Management (cont'd)
16	I am concerned about my inability to manage all the innovation requires. I am concerned about my inability to manage all that teaching handicapped students in regular classes requires. I am concerned about my inability to manage all that mainstreaming requires. I am concerned about my inability to manage all that teaching handicapped students in my regular class requires.
25	I am concerned about time spent with non-academic problems related to this innovation. I am concerned about time spent working with non-academic problems related to teaching handicapped students in regular classes. I am concerned about time spent working with non-academic problems related to mainstreaming. Good for branching, say, to discipline issues. I am concerned about time spent working on non-instructional problems related to teaching handicapped students (paperwork, discipline).
34	Coordination of tasks and people is taking too much of my time. In my opinion, the coordination of tasks and people required by mainstreaming is taking too much of my time. Stein "in my opinion"; term mainstreaming fits better. Coordination of tasks and planning with people is taking too much of my time.
	Stage 4 Consequences
1	I am concerned about students' attitudes toward this innovation. I am concerned about students' attitudes toward teaching handicapped students in regular classes. I am concerned about other students' attitudes toward having handicapped students in the class. I am concerned about students' attitudes toward handicapped children in the regular classroom. Again question of "handicapped."
11	I am concerned about how the innovation affects students. I am concerned about how students are affected by teaching handicapped students in regular classes. I am concerned about how mainstreaming affects: a) regular students b) special needs student I am concerned about how including handicapped students in my class will affect both them and the regular students.
19	I am concerned about evaluating my impact on students. I am concerned about evaluating my impact on the special needs children in my class. I am concerned about evaluating my effectiveness as a teacher of a class containing some handicapped students.

Item Number	Statement
	Stage 4 Consequences (cont'd)
24	I would like to excite my students about their part in this approach.
	I would like to excite (involve) all my students about their part in mainstreaming. Are students aware of this change?
	I would like to promote a positive attitude among my students toward including handicapped students in the class and in class activities.
32	I would like to use feedback from students to change the program.
	I would like to use feedback from students to guide my efforts as a teacher of the handicapped students in my class.
	I would like to use feedback from students to improve mainstreaming.
	Stage 5 Collaboration
5	I would like to help other faculty in their use of the innov-tion.
	I would like to help other faculty in teaching handicapped students in regular classes.
	I would like to help other teachers in their teaching of mainstreamed classes.
	I would like to help other teachers to develop strategies for teaching handicapped students in their classes.
10	I would like to develop working relationships with both our faculty and outside faculty using this innovation.
	I would like to develop working relationships with both our faculty and outside faculty in teaching handicapped students in regular classes.
	I would like to work more closely with teachers in our school and other schools who are teaching in mainstreamed classrooms. Include "Not applicable" box.
	I would like to develop working relationships with faculty in my school and other schools who are working with handicapped students in their classes.
18	I would like to familiarize other departments or persons with the progress of this new approach.
	I would like to familiarize other departments or persons with the progress of teaching handicapped students in regular classes.
	I would like to familiarize other teachers with the benefits (and problems) of having handicapped students in their classes.
	I would like to familiarize other people (e.g. parents) with the progress of mainstreaming.
27	I would like to coordinate my effort with others to maximize the innovation's effects.
	I would like to coordinate my effort with others to maximize the effect of teaching handicapped students in regular classes.
	I would like to coordinate my efforts with other teachers to maximize the benefits of teaching handicapped students in regular classes.
	I would like to coordinate my efforts with others to maximize benefits of mainstreaming.

Item Number	Statement
	Stage 5 Collaboration (cont'd)
29	I would like to know what other faculty are doing in this area. I would like to know what other faculty are doing related to teaching handicapped students in regular classes. I would like to know what other faculty are doing in mainstreaming. I would like to know what other faculty members are doing in this area.
	Stage 6 Refocusing
2	I now know of some other approaches that might work better. I now know of other approaches that might work better in teaching handicapped students in regular classes. I now know of some strategies for teaching handicapped students that are more effective than others for teaching handicapped students in regular classrooms. I know of some other approaches besides mainstreaming that would better meed the educational needs of handicapped children children. (reforming means "innovation has occured."
9	I am concerned about revising my use of the innovation. I am concerned about revising my approaches to teaching handicapped students in regular classes. I am concerned about revising....... Difficult to apply. Direction of concern. I am concerned about revising the way I have been teaching the handicapped students in my classroom.
20	I would like to revise the innovation's instructional approach. I would like to revise the approach to teaching handicapped students in regular classes. I have some new instructional approaches for dealing with handicapped children in the regular classroom. Broadness of notion of "handicapped." I would like to revise the instructional approach to teaching handicapped students in regular classrooms.
22	I would like to modify our use of the innovation based on the experience of our students. I woul like to modify our teaching of handicapped students in regular classes based on the experiences of our students. I would like to modify our approach to mainstreaming based on the experiences of my students. Are mainstreaming approaches defined from school to school?) I would like to modify our approach to teaching handicapped students based on the experiences of our students.
31	I would like to determine how to supplement, enhance, or replace the innovation. I would like to determine how to supplement or enhance our approach to teaching handicapped students in regular classes. I would like to determine how to supplement, enhance or replace mainstreaming as it is implemented in my school. I would like to determine how to supplement, enhance, or replace the approaches we currently use for teaching handicapped students in regular classes.

Appendix B of Technical Report # 401

Final Version of Revised SoC

Figure 2
Complete Pilot Study Questionnaire

Directions: Please fill in the descriptive information below.

1. Sex: ___ (1) Male ___ (2) Female

2. Age: ___ (1) 20-25 ___ (2) 26-30 ___ (3) 31-35 ___ (4) 36-40
___ (5) 41-45 ___ (6) 46-50 ___ (7) 51-55 ___ (8) 56 or above

3a) Current role:

___ (1) Regular Teacher

___ (2) Special Education Teacher

___ (3) Administrator or Supervisor

___ (4) Other ______________________
(please specify)

3b) Current level:

___ (1) Preschool

___ (2) Primary

___ (3) Intermediate

___ (4) Middle-Junior high

___ (5) Senior high

___ (6) K-12

4. Years of experience in current role: ______
5. Total years of experience in education: ______

6. What training have you had in special education?

____ (1) None
____ (2) One course or workshop
____ (3) Two to four courses or workshops
____ (4) More than four courses or workshops
____ (5) Certification or degree in special education

7. Experience teaching special education.

____ 1. Very little or no experience
____ 2. Regular classes with a few mainstreamed special education students
____ 3. Teaching many mainstreamed special education students
____ 4. Special education teacher
____ 5. Other ________________________________
(please specify)

8. Check those adjectives which apply to the experience indicated above.

___ successful ___ pleasant

___ unsuccessful ___ unpleasant

CONCERNS QUESTIONNAIRE

The purpose of this questionnaire is to determine what people who are or may be involved in mainstreaming are concerned about at various times. Since the term "mainstreaming" can be interpreted in different ways, we have included the following information. Please read this before completing the questionnaire.

Mainstreaming

Not too long ago, students needing special education services were removed from the "mainstream" of regular education and placed in separate, self-contained special education classes or schools. These students were largely separated physically, socially, instructionally and administratively from regular programs.

In the 1960's, people began to question this approach. It seemed that many special education students were being unfairly stigmatized and isolated from the general student population, and that these students were unnecessarily restricted in their access to the services and activities available to regular students. Further, and perhaps most suprisingly, the services provided by special education could not be shown to have educational benefits for a large portion of the special education population. Perhaps the students were "living down" to the expectations of special education.

Thus, for more than a decade there has been a growing trend toward "mainstreaming" special education students into regular programs. This trend is even reflected in a federal law (P.L. 94-142). Ideally, mainstreaming should have the following characteristics:

1. To the maximimum possible extent, special education students are integrated into regular programs. This integration has the following aspects:

    a. physical integration: To the maximimum possible extent, special education students are taught in physical proximity to regular education students. This means that some special education students who would once have been placed in self-contained special schools are now placed in special classes within regular schools. Some special education students who would once have been placed in self-contained classes in regular schools are now placed in regular classes for some or most or even all of the school day.

    b. social integration: Physical integration permits social interactions to occur between special education students and regular education students. This does not mean that mainstreaming requires teachers to plan structured social interactions between regular and special education students. Nor does it mean that all social interactions must be desirable and pleasant. It simply means that mainstreaming removes some of the school-created barriers that once contributed to an almost total social separation between regular and special education students.

c. **instructional integration:** To the maximum possible extent, special education students receive the normal content and methods of instruction from the regular education program. Adaptations are made on an individual basis only to the degree made necessary by the student's special needs.

d. **administrative integration:** Mainstreaming is not possible without administrative linkage between regular and special education programs. Special education students are the shared responsibility of regular and special education.

2. A range of levels of special education are available. Some people mistakenly believe that mainstreaming requires that all students be removed from special education and placed in regular education. The real trend is to develop a range of alternatives which include older approaches (self-contained special classes, special schools, residential facilities, etc.) and newer approaches (resource rooms, regular class placement with special aides and supports, etc.).

Anyone associated with today's schools is aware that mainstreaming is already being implemented. Considerable progress has been made, but few (if any) schools or school systems have perfected the process. Strong evidence suggests that mainstreaming will be an enduring feature of American education.

Instructions for the Questionnaire

Please respond to the following items in terms of your present concerns, or how you feel about your involvement or potential involvement with mainstreaming. Items that represent concerns you do have should be marked on the scale according to the degree of intensity. Items that seem completely irrelevant should be marked "0".

For example:

This statement is very true of me at this time.	0 1 2 3 4 5 6 [✓ 7]
This statement is somewhat true of me now.	0 1 2 3 [✓ 4] 5 6 7
This statement is not at all true of me at this time.	0 [✓ 1] 2 3 4 5 6 7
This statement seems irrelevant to me.	[✓ 0] 1 2 3 4 5 6 7

Remember to respond to each item in terms of your present concerns about your involvement or potential involvement in mainstreaming.

THANK YOU FOR TAKING TIME TO COMPLETE THIS SURVEY.

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

1. I am concerned about my other students' attitudes toward having mainstreamed students in the classroom. 0 1 2 3 4 5 6 7

2. I know of some other approaches besides mainstreaming that would better meet the educational needs of all students. 0 1 2 3 4 5 6 7

3. I didn't know mainstreaming was taking place in my school. 0 1 2 3 4 5 6 7

4. Because of having mainstreamed students in my classroom, I am concerned about not having enough time to organize myself each day. 0 1 2 3 4 5 6 7

5. I would like to help other teachers to develop effective strategies for mainstreaming. 0 1 2 3 4 5 6 7

6. I have very limited knowledge about teaching mainstreamed students. 0 1 2 3 4 5 6 7

7. I am concerned about changes in my professional status caused by teaching mainstreamed students. 0 1 2 3 4 5 6 7

8. I am concerned about the conflict between my interests in teaching in general, and my responsibilities to teach mainstreamed students. 0 1 2 3 4 5 6 7

9. I am concerned about revising the way I have been teaching students in my mainstreamed classroom. 0 1 2 3 4 5 6 7

10. I would like to develop working relationships with faculty in my school and other schools who are teaching mainstreamed students. 0 1 2 3 4 5 6 7

11. I am concerned about how my regular students are affected by having mainstreamed students in the classroom. 0 1 2 3 4 5 6 7

12. I am not concerned about teaching mainstreamed students in my classroom. 0 1 2 3 4 5 6 7

13. I would like to know who will make decisions about the placement of mainstreamed students in my classroom. 0 1 2 3 4 5 6 7

14. I would like to discuss approaches to teaching a mainstreamed class. 0 1 2 3 4 5 6 7

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

15. I would like to know what resources would be available to me for teaching mainstreamed students in my classroom. 0 1 2 3 4 5 6 7

16. I am concerned about my inability to manage all that teaching mainstreamed students requires. 0 1 2 3 4 5 6 7

17. I would like to know how my teaching is supposed to change when I have mainstreamed students in my class. 0 1 2 3 4 5 6 7

18. I would like to familiarize others with the progress of mainstreaming. 0 1 2 3 4 5 6 7

19. I am concerned about evaluating my effectiveness as a teacher of class containing some mainstreamed students. 0 1 2 3 4 5 6 7

20. I would like to revise the instructional approach to mainstreaming. 0 1 2 3 4 5 6 7

21. I am completely occupied with other things. 0 1 2 3 4 5 6 7

22. I would like to modify our approach to mainstreaming based on the experiences of my students. 0 1 2 3 4 5 6 7

23. Although I don't know anything about mainstreaming, I am concerned about issues of Special Education. 0 1 2 3 4 5 6 7

24. I would like to promote a positive attitude among my students about having mainstreamed students in class. 0 1 2 3 4 5 6 7

25. I am concerned about time spent working with non-academic problems related to teaching mainstreamed students. 0 1 2 3 4 5 6 7

26. I would like to know what other changes in teaching mainstreamed students might be taking place in the near future. 0 1 2 3 4 5 6 7

27. I would like to coordinate my efforts with others to maximize the benefits of mainstreaming. 0 1 2 3 4 5 6 7

28. I would like to have more information on expected time and energy commitments required by the presence of mainstreamed students in my classroom. 0 1 2 3 4 5 6 7

0 1 2 3 4 5 6 7

Irrelevant Not true Somewhat true of me now Very true of me now

29. I would like to know what other faculty are doing regarding mainstreaming. 0 1 2 3 4 5 6 7

30. At this time, I am not interested in learning about teaching mainstreamed students. 0 1 2 3 4 5 6 7

31. I would like to determine how to supplement, enhance or replace the approaches we currently use for mainstreaming. 0 1 2 3 4 5 6 7

32. I would like to use feedback from my students to improve the implementation of mainstreaming. 0 1 2 3 4 5 6 7

33. I am concerned about changes in my role due to the placement of mainstreamed students in my classroom. 0 1 2 3 4 5 6 7

34. In my opinion, the coordination of tasks and people required by mainstreaming is taking too much of my time. 0 1 2 3 4 5 6 7

35. I would like to know the rational for mainstreaming. 0 1 2 3 4 5 6 7

Appendix G

Technical Report #203

Exploratory Data Analysis for Descriptive Profile Development

TECHNICAL REPORT #203

Exploratory Data Analysis for Descriptive Profile Development

Doug Coulson
David B. Malouf

July, 1986

Special Project: Microcomputer-Assisted Needs Assessment System for Teacher Training in Special Education

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Abstract

Visual analysis of individual profiles may overlook important differences or yield differences that are unimportant. The procedure described here provides an empirical basis for choosing a simple descriptive algorithm for identifying important features of individual profiles (i.e., outliers).

An exploratory data analysis technique was used to determine the best descriptive statistical algorithm for identifying outliers on an attitude questionnaire with six subscales. Four algorithms based on descriptive statistics were developed to identify outliers among the six subscales. Profiles from individuals in two samples (n=40; n=35) were studied. Algorithms with increasing narrower decision bands were plotted against the number of outliers produced by each algorithm. The results showed two algorithms to be superior for identifying outliers in the individual profiles. This exploratory technique is useful for profile analysis when there is insufficient data points for statistical tests and when visual analysis may yield inconsistent results.

Exploratory Data Analysis
for
Descriptive Profile Development

INTRODUCTION

This paper reports the results of an exploratory data analysis technique used to determine the best descriptive statistical algorithm for profiles from an attitude questionnaire with six subscales (i.e., Stages of Concern Questionnaire; Hall, 1979). Four algorithms based on descriptive statistics were developed to identify "outliers" among these 6 subscales. In order to select the most successful algorithm (in terms of criteria described below), the exploratory analysis procedure plotted the percent of observed outliers as a function of the four algorithms.

"Outliers" and patterns of outliers form an important starting place for interpreting group and individual profiles. Outliers may be identified by a variety of methods from simple visual inspection to complex statistical approaches described in Kratochwill [1] and [2]. Identifying outliers thus requires either a judgment based on visual inspection of their relative positions or the application of quantitative criteria which provides normative information on the location of subscale means. In some cases visual inspection is sufficient because differences are large, in other cases visual inspection is the only viable option due to an inadequate number of data points upon which to base the statistics. However, the visual inspection method does not give the practioner external criteria to sort out which subscale means are "close" and which are "outliers" from the others.

Unfortunately, from a traditional statistical view point, when subscale means are only based on a few data points which are from the same subject (i.e., 5 dependent data points in this study) statistical tests of significance are inadequate and inappropriate. Nevertheless, 5 data points does yield the range of descriptive indices such as the mean, standard deviation and standard error.

The strategy presented in this paper was to plot the results of several different descriptive statistical algorithms and interpret this function in terms of what an analysis of profiles generally would lead to: profiles with varying numbers of outliers. Thus, the criteria for an algorithm to be successful is that it must lead to some outliers but not identify all the subscale means as outliers. In other words, a profile with no outliers is not informative, nor is a profile that is all outliers very informative.

Specifically, the statistical algorithm reported in this paper presents simple descriptive statistical criteria which will allow the practioner to determine the relative "closeness" of the subscale means in the profiles. The major advantage of this algorithm over visual inspection is the ability of the algorithm to apply statistics (i.e., mean, standard deviation and standard error of the mean) to assist in the judgment of relative "closeness" of profile means.

THE SCALE

The scale used in this study is the Stages of Concern About the Innovation Questionnaire (SoC) which was developed by Gene Hall and his associates to measure dimensions of concern about an innovation [3]. For example, when a new technology, such as microcomputer operated video disks, is introduced into selected classrooms, the SoC can be used to study the affective impact of this technology on teachers. Teachers may register mostly personal concerns about the technology or they may seek to collaborate with others for more effective applications of the technology.

The "innovation" in the context of this study is mainstreaming. While mainstreaming cannot be considered an innovation in the usual sense because it is legally mandated, it does represent an identifiable change in the classroom. As such it makes sense to measure attitudes and concerns about it.

The SoC subscales used in this study were two through seven. Although items were reworded slightly to reflect concerns about mainstreaming, a mandated innovation, in general the wording was consistent with the original items. The items associated with each subscale are randomly placed throughout the questionnaire. The revised SoC questionnaire is included in an appendix to this report.

DESCRIPTIVE PROFILE ANALYSIS

This study is part of a project which deals with the application of microcomputer based technology and data based management to the development of training suggestions for regular teachers in the mainstreamed classroom. One entry point into this system will be through the SoC questionnaire. The SoC was selected because it provided a profile of teacher concerns relative to mainstreaming without reducing concerns to a single dimension as many attitude scales do. From the SoC profiles and other sources of data the microcomputer based decision rules will channel through the training options and select ones considered most appropriate for a particular teacher.

The SoC questionnaire is one of the main entry points into the training options data base. Its successful application depends on: a) subscales being logically related to training options; and b) subscale variation which can generate a variety of different profiles. Without variation among the subscale means, differential decisions would not be possible.

SoC profiles may be examined from two general perspectives: a) normative perspective; and b) criterion perspective. The research reported by Hall, George and Rutherford [3] takes a normative approach to profile interpretation. They report a raw score-percentile conversion chart which is based on the responses of 646 individuals who completed the questionnaire in the spring of 1975. A stratified sample was taken from elementary and higher education institutions to rate the innovation of "teaming" or "modules". The authors argue that experience has shown that the percentiles are representative of other innovations. Their approach is normative in that the interpretation of group and individual profiles is accomplished by converting the raw subcale scores into percentiles from the conversion chart.

On the other hand one can argue that the examination of a single person's profile may be a criterion referenced task. In this case one would compare the six raw score means of an individual respondent rather than transform their raw scores into normed percentiles. This kind of analysis would be criterion referenced because the meaning of the profile would not rely on the profiles of other individuals, which would be necessary to get the percentile scores. It is this latter interpretation which is sought for a descriptive profile analysis. To this end the normative percentiles reported by Hall et al [3] are not used; instead the analysis is developed from raw scores and means.

ALGORITHM DEVELOPMENT

There are two major ways that profiles can be analyzed. The first simply involves visual inspection. One examines a profile and rank orders the subscale means from highest to lowest. Once the rank ordering is complete, an interpretation of the pattern is made. This is the method used by the developers of the SoC. For example, Hall and his associates suggest that the highest subscale score for each individual be circled, thereby drawing attention to that subscale. Hall categorizes different profiles as single peak and multiple peak "user" and "nonuser" profiles. This latter classification ("nonuser") was not of interest here because there are no nonusers of the mainstreaming concept. Unfortunately, Hall does not give criteria for distinguishing between single and multiple peaks; such criteria would be important because all the subscale peaks usually have different values.

The second approach to profile analysis applies criteria in order to make distinctions between the various subscale means. The criteria provide the researcher with an empirically based indication of which scales are considerably different from the others. Since the means were only based on 5 data points, traditional statistical significance testing was inappropriate. Instead, a method was sought which would identify outliers only when it seemed visually or logically that outliers were present. The success of the algorithm depended on its ability to sort profiles into profiles with outliers and without outliers. Algorithms were selected so that they generated increasingly narrow intervals around the overall mean and the six subscale means. A percent of outliers (i.e., "at least one outlier per subject" or "multiple outliers per subject") was calculated for each algorithm.

Four algorithms were tested. The first built an interval around the grand mean based on the standard deviation of the individual's responses to the 30 items and a series of intervals around the subscale means based on the standard deviation of the individual's responses to the 5 items of that subscale (1SD/1SD). The second algorithm was the same as the first except that the standard errors of the respective subscale means was used rather than the standard deviations (1SD/1SE). The third algorithm used one half a standard deviation for the grand mean interval and one standard error of the subscale means for the subscale intervals (.5SD/1SE). The last algorithm gave the narrowest intervals and was one half of a standard deviation for the grand mean and one half of a standard error for the six subscale means (.5SD/.5SE).

METHOD

Data were collected from two separate samples of teachers. Sample #1 consisted of 40 teachers from education classes during a summer session at the University of Maryland. This group received the SoC questionnaire in paper and pencil form. Sample #2 consisted of 34 teachers and 1 supervisor who were participating in summer workshops or developing materials in their county Staff Development Center. This group completed the SoC inventory via microcomputer.

The first sample was used to test the four algorithms and the second sample was used to replicate the results from the first sample. Both groups were samples of convenience which limits the generalizability of the results.

RESULTS

For sample one the first algorithm (1SD/1SD), which gave the widest intervals, resulted in no single or multiple outliers. For the second algorithm (1SD/1SE) 12.5% of the 40 subjects had at least one outlier and 0% had multiple outliers. Algorithm three (.5SD/1SE) showed 82.5% of the subjects with at least one outlier and 45% with multiple outliers. The results for algorithm four (.5SD/.5SE) were similar to algorithm three with 85% of the subjects showing at least one outlier and 47.5% of the subjects with multiple outliers.

For sample two, the first algorithm (1SD/1SD), also resulted in no single or multiple outliers. The second algorith (1SD/1SE) resulted in 5.7% of the 35 subjects showing at least one outlier; 0% had multiple outliers. Algorithm three (.5SD/1SE) showed 62.9% with at least one outlier and 40% with multiple outliers. The results for algorithm four were similar to three, with 68.5% showing at least one outlier and 37% showing multiple outliers.

Figure One plots the "at least one outlier" and "multiple outlier" lines for each of the four algorithms for samples 1 and 2.

INSERT FIGURE ONE HERE

DISCUSSION

Visual analysis of individual profiles may overlook important differences or yield differences that are unimportant. The procedure described here provides an empirical basis for choosing a simple descriptive algorithm which meets certain requirements. Specifically the selected algorithm should identify profiles that have some outliers. If all the individual profiles are seen to have outliers or none of the profiles are seen to have outliers, then the analysis may be said to grossly overidentify or underidentify differences within the sample. While it is conceivable that all individuals in a sample could either show flat or variable profiles, it is not likely for a "normal" sample. Thus the successful algorithm will identify some individuals as having flat profiles and others as having variable profiles.

Figure One clearly shows that the first two algorithms yielded flat profiles for all individuals in the sample. Algorithm 3 showed a sharp rise in the number of profiles that were not flat (i.e., no outliers) and algorithm 4 showed a leveling in the number of variable profiles identified relative to algorithm 3.

This step function result indicates that algorithms 1 and 2 are unsuitable for descriptive profile analysis. That is, these two algorithms do not yield results that would be expected from a sample with "normal" differences among its members; simply put, there are not enough outliers identified. Thus, algorithms 1 and 2 are rejected.

However both algorithms 3 and 4 were successful in that they identified 40% and 47.5% of the profiles as having multiple outliers, and between 62.9% and 85% of the profiles as having at least one outlier. Furthermore, the algorithm by % outlier function steps up dramatically at algorithm 3 and levels off somewhat as it moves over to algorithm 4. Thus, it appears that algorithms 3 and 4 would be equally suitable for identifying outliers in the kind of descriptive profile analysis discussed here.

Finally, in order to illustrate the usefulness of having an algorithm assist in the description of individual profiles, algorithm 3 was applied to two selected individuals from sample #1. Their profiles are presented in Figure 2 below. What does a visual analysis of these profiles indicate?

INSERT FIGURE 2 HERE

Visual inspection might indicate that individuals 1 and 2 each had one low outlier (3.0 and 3.6 respectively). However, when algorithm 3 is applied to these profiles, individual 1 has no outliers and the second individual has two outliers (i.e., 5.8 and 3.6). What is not visually represented in these graphs as the standard deviations. Clearly, the responses given by the first individual are more variable than those of the second.

From this example, visual inspection does not probe into the variability and equally important not all methods of incorporating the standard deviation would be successful. Figure Three shows the same two individual profiles with the actual data points included (five data points did not always show up because some of the values overlapped). From Figure Three it is clear which profile is less variable and therefore more likely to yield outliers.

INSERT FIGURE 3 HERE

By looking across the profiles of a sample of individuals, a method has been presented to select an algorithm (or procedure) for identifying outliers on individual profiles. This exploratory data analysis technique used statistics in a descriptive way to locate outliers on each profile. A particular set of descriptive statistics (i.e, .5SD/1SE) was selected over other choices by plotting the outcomes of different descriptive statistical algorithms against outcomes (% outliers), and chosing the algorithm that resulted in a set of outcomes (% at least one outlier; % multiple outliers) expected of a sample with "normal" variability. Finally the results were replicated with a second sample.

References

Barnett, V. and Lewis, T. (1978) Outliers in Statistical Data. New York: J. Wiley.

Hall, G.E., George, A.A. and Rutherford, W.L. (1979) Measuring Stages of Concern about the Innovation: A Manual forthe use of the SoC Questionnaire. Austin, Texas: University of Texas.

Kratochwill, T.R. (1978) Single Subject Research: Strategies for Evaluating Change. New York: Academic Press.

Figure One

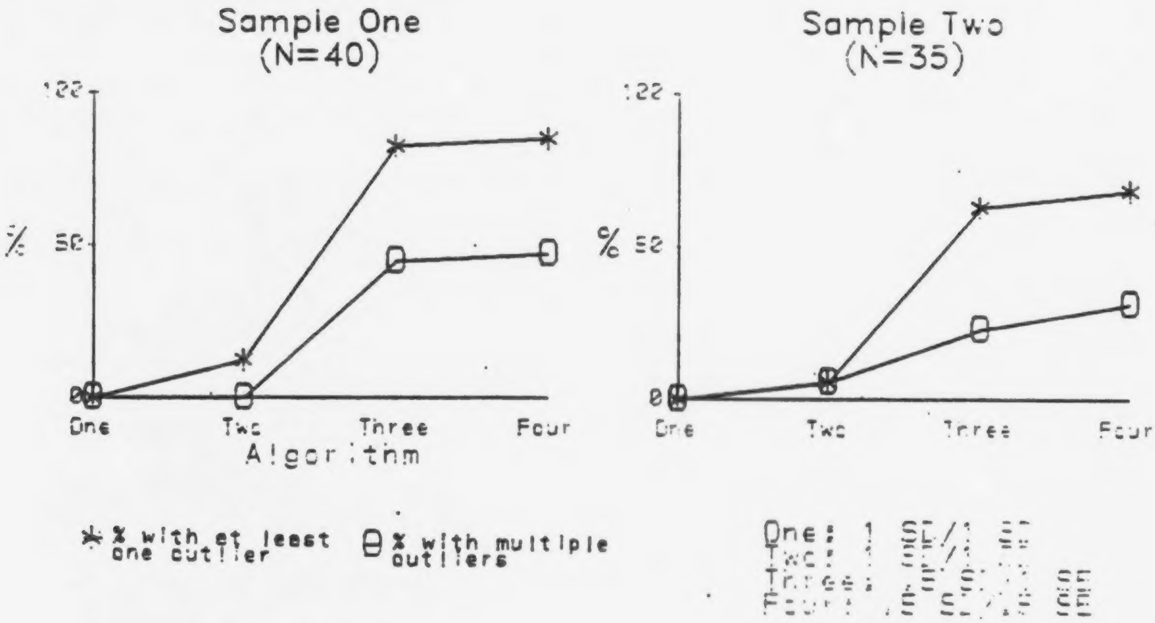

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Figure Two

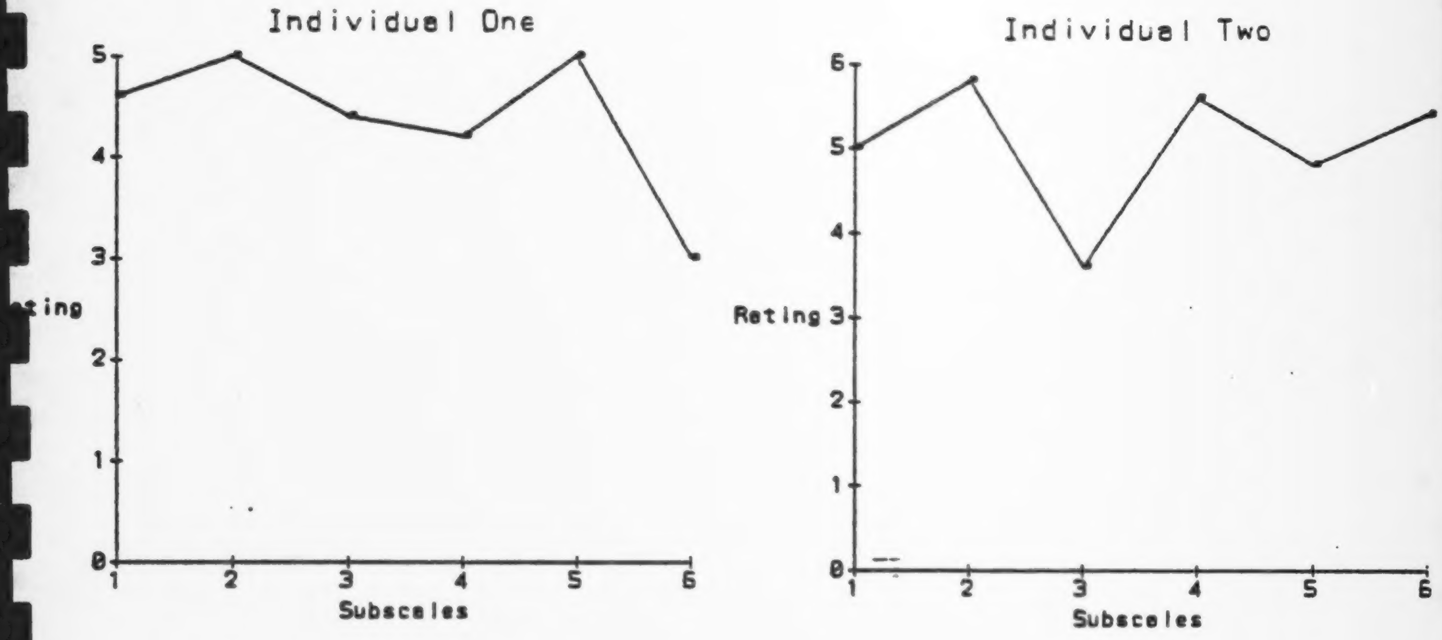
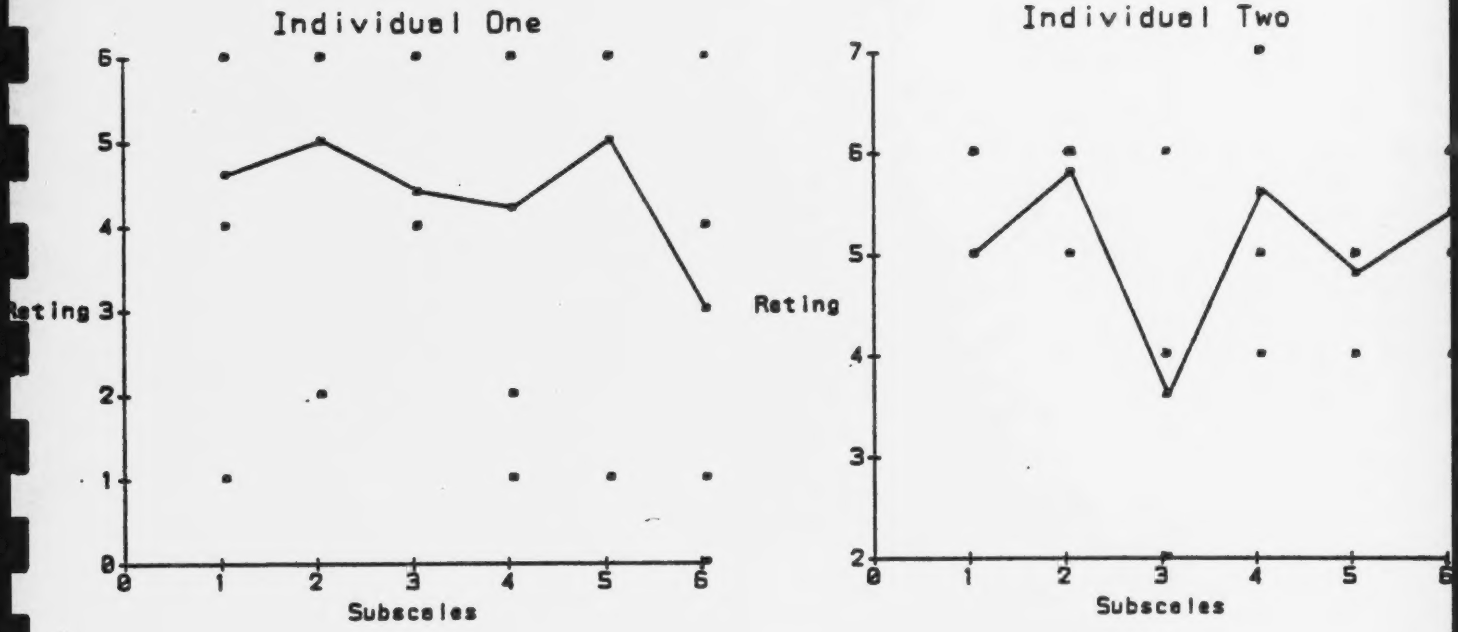

Individual One
5
4
3
2
1
0
ting
1
2
3
4
5
6
Subscales
Individual Two
6
5
4
3
Rating
2
1
0
1
2
3
4
5
6
Subscales

Figure Three


Individual One

Individual Two

Appendix H

Learning Goals Field Test

Learning Goals Field Test

The Learning Goals instrument was tested with Howard County teachers during the summer 1985. The following description identifies the sample and explains the data collection procedures.

Sample. The Howard County Director of Staff Development provided SNAP personnel access to Howard County teachers at two locations--a high school, where curriculum workshop participants were grades K-12, and the Staff Development Center, where teachers of all grade levels met to develop instructional materials and to participate in workshops. A total of 35 educators (34 teachers and 1 supervisor) completed the Learning Goals inventory. Nineteen teachers were secondary, and fifteen were elementary. Secondary teachers were in the teaching areas of science, social studies, and physical education.

Procedures. Teachers met with a SNAP researcher on a one-to-one basis. The researcher gave the teacher a copy of the Learning Goals inventory, a set of 25 items in a Likert scale (1=not useful; 5=essential) format. The researcher told the teacher to rate each item according to the degree of usefulness to the teacher in the teacher's present teaching assignment. (The supervisor was asked to rate each item for usefulness in her supervisory position.)

At the completion of the inventory, the researcher examined the form for the number of "5" ratings. If the teacher had rated more that 5 items with a "5", the researcher asked the teacher to mark his or her 5 most essential items with an asterisk. The explanation to the teacher was that when the inventory is on the computer, teachers will be asked to follow a similar procedure for identifying no more than 5 essential learning goals.

Descriptive Analysis of Data Collected

Twenty five learning goals were presented to 34 teachers and 1 supervisor as part of a SNAP pilot study conducted in the summer of 1985. Analyses descriptive of the interrelationships between the 25 learning goals were based on exploratory factor analysis. A simpler approach based on learning goal intercorrelations was rejected as not feasible because of the number of intercorrelations that would need to be inspected (i.e., [25 x 24]/2 = 300).

Due to wording not consistent with the rating task, learning goal 25 was discarded. This decision was corroborated by an initial factor analysis which included learning goal 25 and showed it to be the only variable to load on factor 5. The second factor analysis (principal components) yielded 5 factors accounting for 75.7 percent of the variance. The percentage of variance for each factor were:

Factor	Percent of Variance

1	44.5
2	12.3
3	8.8
4	5.6
5	4.5

It was decided to run a third and final factor analysis restricting the solution to only three factors. The results were:

Factor	Percent of Variance
1	43.9
2	11.6
3	9.3

An oblique rotation was applied in order to achieve maximum differentiation between the learning goals.

An arbitrary factor structure coefficient (correlation between the variable and the factor) of .6 was established as the criterion for whether or not a variable was associated with a factor. The results are given below.

FACTOR ONE: Learning Goals - 1 through 10 and 21 through 24

FACTOR TWO: Learning Goals - 11 through 15, and 8, 23

FACTOR THREE: Learning Goals - 16 through 18

Learning goals 19 and 20 did not substantially correlate with any of the three factors.

Examination of the content of the 24 learning goals suggests the following interpretation. Factor One learning goals are more general in nature and deal with both approaches to instruction and overall aspects of motivation (e.g., "How to deal with student's behavioral or motivational problems). Two exceptions to this interpretation of Factor One would be learning goals 7 and 8 - the use of classroom aids and gaining access to instructional materials. These two items are more specific than the others associated with Factor One.

Factor Two deals specifically with "How to do it" problems. For example, learning goal 11 concerns "how to select and adapt materials to teach students who have trouble learning". Note also that learning goal 8 which is associated with Factor One, also is associated with Factor Two. Learning goal 8 is specific: "How to gain access ot instructional materials, equipment, etc. for mainstreamed students".

Factor Three deals with record keeping and assessment. The three learning goals for Factor Three ask about grading, tracking and determining skill level.

The two learning goals not associated with any factor appear to be redundant with the items in Factor Three. Learning goal 19 is nearly a verbatim repeat of 18, and learning goal 20 deals with student records and is redundant with 16 and 17.

Age by learning goal correlations were computed. Age was statistically correlated with learning goals 11 and 14. In both instances the correlations were negative. These learning goals dealt with specific concerns (Factor Two): 1) selecting and adapting materials for students with learning troubles; and 2) providing instruction for slower students without disrupting instruction for other students. The negative correlation indicates that older (and presumably more experienced) teachers already know how to do these things and therefore these learning goals are not useful.

The factor analysis and correlational results are presented as descriptive information. Their interpretation must be informed by logical analysis and further empirical results. Nonetheless these results, particularly the factor analyses, provide a way of organizing the learning goals into a more general framework suggested by the three factors.

Appendix I

Training Options Database

```
Cipher in the Snow-Record #2
   AFFECTMODE=p (A)
   DSPEC= ed (M) ld (M)
   GOALS = d (H)
   SOC = pr (H) cq (M)
   TLEV = el (H) jr (M) sh (N)

instruc activity r3
   AFFECTMODE = (A)
   ALTPROB = sl (M)
   LSPEC = lai
   GOALS = k (M) l (H) e (H) i (M) o (H) r (H) w (M)
   SOC = pr (H) cl (H) rf (M)
   SITREQ = hse]

Exceptional Students in the  Mainstream-ch. 1 and ch. 15
Teacher Preparation intro r5
   GOALS = b(M) c (M) d (H)
   SOC = in (A)]

Exceptional Students in the Minstream - ch.2
The Mentally Retarded mr r6
   DSPEC = mr (M)
   GOALS = d (H) c (M)
   SOC = in (A)
   TLEV = el (H) jh (M)

Exceptional Students in the Mainstream-ch.3
The Learning Disabled ld r7
   DSPEC = ld (M)
   GOALS = d (H)
   SOC = in (A)
   TAREA = la (H) ma (H) ss (H) sci (H) h (H) ]

Exceptional Students in the Mainstream - ch. 5
The Orthoped/Chron Ill ld r8
   DSPEC = oi (M) ci (M)
   GOALS = d (H)
   SOC = in (A)]

Exceptional Studentss in the Mainstream - ch.6
The Hearing Impaired r9
   DSPEC = h (M)
   GOALS = d (H)
   SOC = in (A)]

Exceptional Students in the Mainstream - ch. 7
The Visually Impaired r10
   DSPEC = v (M)
   GOALS = d (H)
   SOC = in (A)]

Exceptional Students in the Mainstream - ch. 9
The Speech Impaired r11
```

```
    DSPEC = spl (M)
    GOALS = d (H)
    SOC = in (A)]

Exceptioanal Students in the Mainstream - ch. 13
The Emotionally Troubled r12
    DSPEC = ed (M)
    GOALS = d (H)
    SOC = in (A)]

IEP'S r13
    GOALS = a (M)
    SOC = (A)]

Cry Sorrow, Cry Hope r18
    DSPEC = mr (M)
    GOALS = d (H)
    SOC = pr (M)
    TLEV = el (M)]

I'll Dance at Your Wedding r19
    AFFECTMODE = p (A)
    DSPEC = h (M)
    GOALS = D (M)
    SOC = pr (H)
    TLEV = el (M) jh (M)]

Hewitt'e Just Different r20
    AFFECTMODE= p (A)
    DSPEC = mr (M)
    GOALS = m (M) d (M)
    SOOC pr (M) cq (H)
    TLEV = el (H) jh (M)]

Non-instructional Activity with Handicapped Child r21
    AFFECTMODE = p (A)
    DSPEC = cp (M)
    GOALS = d (H)
    SOC = PR (H)]

Finding a Voice and Like Other People r22
    AFFECTMODE = p (H)
    GOALS = d (H)
    SOC = pr (H)]

"Including Me" and Bibliography r23
    AFFECTMODE = p <H>
    GOALS = d <H>
    SOC = in <M> pr <M>

Case Study r24
    AFFECTMODE = a <A>
    LSPEC = lai
    GOALS = d <M> e <H> i <M> l <M>
```

```
   SOC = in <M> pr <M> cq <M> rf <M>
   SITREQ = hhc]

"Reversals r25
   AFFECTMODE = p <A>
   DSPEC = ld <M>
   GOALS = d <H> e <H>
   SOC = pr <H>

Videotaping with Peer Conferencing r26
   ALTPROB = et <M> sl <M> at <M>
   QUESPROB = or <M> sl <M> rd <M>
   LSPEC = lai
   GOALS = j <H> l <H> m <H> n <H> u <M> v <M> w <M> i <H> e
<M>
   SOC = mn <H> cq <H> cl <H>
   SITREQ = evo]

Videotaping a Mainstreamed Student's Social
Interactions-YourClassr 27
   GOALS = cq <H> rf <M>
   SITREQ `= evo]

Visit to a Mainstreamed Class
   AFFECTMODE = a <A>
   LSPEC = Lai
   GOALS = j <M> l <H> l <M> m<M> n <M> u <M> v <M> w <M>
   SOC = mn <H> cq <M> cl <M> rf <M>
   SITREQ = SAP]

"A Show of hands-Say it in Sign Language" r29
   AFFECTMODE = a <M>
   DSPEC = h <M>
   GOALS = m <H>
   SOC= cq <H>
   TLEV = el <H> sh <N>]

"Don't Drown in the Mainstream" r31
   LSPEC = lms
   GOALS = a <M> b <M> c <M> f <M> g <M> h <M> i <M> j <M> l
<M> m <M> n <M> x <M>
   SOC = in <M> mn <H>
   TAREA = la <H> ma <H> ss <H> sci <H>]

 "Inroducing PL 94-142" and "Complying with PL 94-142"r32
   GOALS = a <M> b <H> c <H>
   SOC = in <H>]

Professional Pairing r33
   AFFECTMODE = a <A>
   GOALS = J <M>
   SOC = in <M> pr <M> mn <M> cq <M> cl <M> rf <M>
   SITREQ = hfa]
```

```
Meet with Handicapped Adults r34
   AFFECTMODE = a <A>
   GOALS = d <H> e <H> m <M> u <M> v <M> w <M>
   SOC = in <H> pr <H> rf <M>]

"Kevin" r35
   AFFECTMODE = p <A>
   DSPEC = v <M>
   GOALS = d <H>
   SOC  = pr <H>
   TLEV = EL <M> JH <M> SH <N>]

"Blind Sunday" r36
   AFFECTMODE = p <A>
   DSPEC = v <M>
   GOALS = d <H>
   SOC = pr <H>
   TLEV = sh <H> el <N>]

"Teaching the Learning Disabled Adolescent: Strategies and
Methods" r40
   DSPEC = 1d <M>
   LSPEC = 1sg
   GOALS 1 <H> m <H> n <H> d <H> e <H>
   SOC = mn <H>
   TLEV = jh <M> sh <H> el <N>]

Trainee as Resarcher r41
   LSPEC = 1ai
   GOALS = k <M>  1 <H> m <H> n <H> o <M> w <H>
   SOC = cq <H> cl <H> rf <H>
   PREREQ = rcr]

"Across the Silence Barrier" r42
   DSPEC = h <M>
   GOALS = <H>
   SOC = in <L> ]

"Organizing and Managing the Elementary School Classroom"
r44
   ALTPROB = et <M> sl <M> at <M>
   QUESPROB = or <M> sl <M> rd <M>
   DIRPROB = low
   LSPEC = 1cm
   GOALS = 1 <H> m <H> n  <H> u <M> v <M> w <M>
   SOC = mn <H>
   TLEV = el <A>
   TAREA = <H> ma <H> ss <H> sci <H>]

Mainstreaming Exceptional Children r45
   GOALS = a <H> b <H> c <H> d <H>
   SOC = in <H>]

Mainstreaming the Hearing Impaired Child r46
```

```
   DSPEC = h <M>
   GOALS = d <H>
   SOC = in <H>]

Mainstreaming the Visually Impaired Child r47
   DSPEC = v <M>
   GOALS = d <H>
   SOC = in <H> ]


Adapting Instruction & Modifying Lesson Plans r48
   ALTPROB = et <M> sl <M>
   QUESPROB = sl <M>
   LSPEC = lsg
   GOALS = k <H> l <H>
   SOC = mn <H> cq <M>
   TLEV = el <H> jh <M>
   TAREA = la <H> ma <H> ss <H> sci <H>]

Alexander Graham Bell Associates for the Deaf, Inc. r49
   AFFECTMODE = a <H>
   DSPEC = h <M>
   GOALS = d <H>
   SOC = mn <M>  rf <H>]

Having a Colleague observe a Mainstreamed Students's Social
Interactions r50
   GOALS = m <H> j <H> i <H> v <M> u <M>
   SOC = cq <H> rf <M>
   SITREQ = hcc]

In-service Workshop for Teachers of Mainstreamed Hearing
Impaired Students
   AFFECTMODE = a <A>
   DSPEC = h <M>
   LSPEC = lai
   GOALS = c <H> d <H> e <H> i <H> j <H> m <M> n <H>
   SITREQ = shi]

American Foundation for the Blind  r52
   DSPEC = v <M> LSPEC = lai
   GOALS = c <H> e <H> i <H> k <H> l <H> m <H> n <H>
   SOC = rf <H>]

American Printing House for the Blind r53
   GOALS = b <H> f <H>
   SOC = MN <M> rf <M>
   SITREQ = cvi]


American Speech and Hearing Association r54
   DSPEC = spl
   LSPEC = lai
   GOALS = l <H>
   SOC = rf <H>
   SITREQ CS1]

Material Evaluation r55
   ALTPROB = et <H> sl <H>
   QUESPROB = sl <M>
   GOALS = q <H>
   SOC = mn <H>]

Association for Children with Learning Disabilities r56
   LSPEC = lai
   GOALS = l <H> b <H>
   SOC = in <M> rf <H>
   SITREQ = cld]

National Interpreter Training Consortium r57
   DSPEC = h <M>
   GOALS = d <M> j <M>
   SOC = in <M> rf <H>

National Paraplegia Foundation r58
   DSPEC = oi <M>
   GOALS = d<H>
   SOC = rf <H>

Recording for the Blind, Inc. r59
   GOALS = h  <H>
   SOC = mn <M> rf <H>

United Cerebral Palsy Association, Inc. r60
   DSPEC = cp <M>
   GOALS = d <H> e <H> i <H>
   SOC = rf <H>]

Spina Bifida Association of America r61
   DSPEC = sb <M>
   GOALS = d <H> i <H>
   SOC = in <M> rf <H>]

Cystic Fibrosis Foundation r62
   DSPEC = cf <M>
   GOALS = d <H> m <M>
   SOC = in <M> rf <H>
   TLEV = sh <H>]

Epilepsy Foundation of America r63
   DSPEC = ep <M>
   GOALS = d <H>
   SOC = in <M> rf <H>

Council for Exceptional Children r64
   GOALS = <H> g<H> h <H> i <H> o <H>
   SOC in <M> mn <M> cq <M> rf <M>]
```

```
Epilepsy School Alert and Epilepsy and the School Age Child
r65
   DSPEC = ep <M>
   LSPEC = lms
   GOALS = d <H> l <H> m <H> n <H>
   SOC = in <M> mn <M> cq <M>]

The Handicapped Experience & Bibliography r66
   AFFECTMODE = p <M>
   SOC = pr <M>]

Exploding the Myth r67
   DSPEC = mr <M>
   GOALS = d <H>
   SOC = in <H>]

Whatever It Takes r68
   AFFECTMODE = p <H>
   LSPEC = lms
   GOALS = l <M> m <M> n <M> o <M> q <M> r  <M> t <M>
   SOC = pr <H>
   TLEV = sh <H>
   TAREA = ve <A>]

Teaching Educatable Mentally Retarded Children r69
   DSPEC = mr <M>
   LSPEC = lms
   GOALS = d <H> e <H> l <H> m <H> n <H>
   SOC = in <M> mn <H>]

David r70
   AFFECTMODE = p <A>
   DSPEC = mr <M>
   GOALS = d <H> e <H>
   SOC pr <H>]

Adolescence and Learning Disabilities r71
   DSPEC = ld <M>
   GOALS = d <H> e <H>
   SOC = cq <H>
   TLEV = el <N> sh <H>
   TAREA = ve <H>]

A Different Approach r72
   AFFECTMODE = p <A>
   GOALS = d <H>
   SOC = pr <H>
   TLEV = sh <H> jh <H> el <M>]

Evaluating Students in the Mainstream r73
   ALTPROB  = sl <H>
   QUESPROB = sl <M>
   GOALS = o <H> p <H> q <H> r <H> t <H>
   SOC = mn <H> cq <M>
   TLEV = el <H> jh <M>
   TAREA = la <H> ma <H> ss  <H> sci <H>]

Self-correcting Learning Materials r75
   ALTPROB = et <H> sl <H>
   GOALS = k <H>
   SOC = mn <H>
   TLEV = el <A>
   TAREA  = la <H> ma <H> ss <H> sci <H>]

The Teacher and the Child with Spina Bifida & An Educator's
Guide to Spina Bifida r77
   DSPEC = sb <M>
   GOALS = d <H> e <H> x <M>
   SOC = in <H>]

Visit a Mainstreamed Class which has an Aide r78
   ALTPROB = et <H>
   GOALS = g <H>
   SOC = mn <H> cq <M> cl <H> rf <M>
   TLEV = EL <A>]

Modifications in Academic Classses r79
   ALTPROB  = et <M> sl <M>
   GOALS = k <H> p <H>
   SOC mn <H> cq <M>
   TLEV = jh <H> sh <H>
   TAREA = la <H> ma <H> ss <H> sci <H>]

Peer Tutoring r80
   ALTPROB = et <H> sl <H>
   LSPEC = lsg
   GOALS = l <H> m <H> n <H>
   SOC = mn <H> cq <H>
   TLEV = el <H> jh <H>
   TAREA = la <H> ma <H> ss <H> sci <H>]

Learning Characteristicss r82
   ALTPROB = et <M> sl <M>
   LSPEC = lsg
   GOALS = e <H> l <H> o <H>
   SOC = in <H> mn <H>]

Remembering r83
   ALTPROB = et <H> sl <H>
   DIRPROB = low
   LSPEC = lsg
   GOALS = l <H>
   SOC = MN <H>
   TLEV = jh <H> sh <H>]

Textbook Usage r84
   ALTPROB = et <M> sl <M>
   DIRPROB = low
   LSPEC = lsg
   GOALS = l <H>
   SOC = mn <H>
   TLEV = jh <H> sh <H>
   TAREA = la <H> ma <H> ss <H> sce <H>]

Visual Aids r85
   ALTPROB = et <M> sl <M>
   DIRPROB = LOW
   LSPEC = LSG
   GOALS = L <H>
   SOC = MN <H>
   TLEV = jh <H> sh <H>
   TAREA = la <H> ma <H> ss <H> sci <H>]

Skimming" & Scanning" r86
   ALTPROB = et <M> sl <M>
   DIRPROB = low
   LSPEC = lsg
   GOALS = l <H>
   SOC = mn <H>
   TLEV = jh <H> sh <H>
   TAREA = la <H> ma <H> ss <H> sci <H>]

Test Skills r87
   ALTPROB = et <M> sl <M>
   DIRPROB = low
   LSPEC = lsg
   GOALS = l <H>
   SOC = mn <H>
   TLEV = jh <H> sh <H>
   TAREA = la <H> ma <H> ss <H> sci <H>]

The Request Procedure r88
   ALTPROB = et <H> sl <H>
   QUESPROB = sl <M>
   DIRPROB = low
   LSPEC = lsr
   GOALS = l <H> m <H> n <H>
   SOC = mn <H>
   TLEV = jh <H> el <M>
   TAREA = la <H> ss <H> sci <H>]

Inducing Use of a Text Lookback Strategy Among
Unsuccessful Readers r89
   ALTPROB = et <H> sl<H>
   DIRPROB = low
   LSPEC = lsr
   GOALS = l <H>
   SOC = mn <H>
   TLEV = el <H> jh <H> sh <M>
   TAREA = la <H> ss <H> sci <H>]

Direct Instruction of Summarization Skills
```

ALTPROB = et <H> sl <H>
DIRPROB = low
LSPEC = lsr <M> lso <M>
GOALS = l <H>
SOC = mn <H>
TLEV = jh <M> sh <H>
TAREA = la <H> ss <H> sci <H>]

Becoming a Strategic Reader r91
ALTPROB = et <H> sl <H>
LSPEC = lsr
GOALS = l <H>
SOC = in <M> mn <H>
TAREA = la <H> ss <H> sci <H>]

Communicating with Parents of Exceptional Children r92
GOALS = x <A>
SOC in <M> pr <M> mn <M> cq <M> cl <M> rf <M>]

Tape Recording Educational Materials for Secondary Handicapped Students r93
ALTPROB = et <H> sl <H>
GOALS = k <H>
SOC = mn <H>
TLEV=jh <H> sh <H>]

When you have a Visually Handicapped Child in your Classroom: Suggestions for Teachers r94
DSPEC = v <M>
GOALS = b <H> c <H> d <M> i <M> l <M>
SOC in <H> mn <H>]

Videotaping for Self-Observation r95
ALTPROB = et <M> sl <M> at <M>
QUESPROB = or <M> sl <M> rd <M>
LSPEC = lai
GOALS = i <H> l <H> m <H> n <H> u <H> v <H> w <H>
SOC = mn <H> cq <H>
SITREQ = evo]

Managing Special Groups in CLassaroom Management for Elementary Teachers r96
ALTPROB= et <H> sl <H>
DIRPROB = low
LSPEC = lcm
GOALS = l <H> m <H> n <H> w <H>
SOC = mn <A>
TLEV = el <A>
TAREA = la <H> ma <H> ss <H> sci <H>]

View Videotape of "Expert" Mainstream Teacher r97
ALTPROB = et <H> sl <H>
QUESPROB or <M> sl <M> rd <M>
LSPEC = lai

```
    GOALS = j <M> i <M> l <H> m <H> n <H> u <M> v <M> w <M>
    SOC = mn <H> cq <H> cl <M> rf <M>
    SITREQ = het]

Observation of Special Education Teachers Working with one
or more Students from Teacher's Class r98
    ALTPROB = et <H> sl <H>
    QUESPROB = or <M> sl <M>
    LSPEC = lai
    GOALS = a <H> b<H> c <H> i <M> l <H>
    SOC = mn <H> cq <M> cl <M>
    SITREQ = sse]

Meeting with Special Education Teachers in August or
September to learn about Teaching New Mainstreamed Students
r99
    ALTPROB = et <H> sl <H.
    LSPEC = lai
    GOALS = f <H> g <H> h <H> i <H> j <H> k <M> l <H> m <H> n
            <H> u <M>
    SOC = in <M> mn <H> cq <M> cl <H>
    SITREQ = stm]

Managing Special Groups in Classroom Management for
Secondary Teachers r100
    ALTPROB = et <H> sl <H>
    DIRPROB = low
    LSPEC = lcm
    GOALS = l <H> m <H> n <H> w <H>
    SOC = mn <A>
    TLEV = el <A.
    TAREA = la <H> ma <H> ss <H> sci <H>]

Interview Parents of Handicapped Child r101
    AFFECTMODE = a <A>
    GOALS = d <H> e <H> x <M> u <M>
    SOC = pr <H>
    SITREQ = hhp]

Meet with Special Education Teachers before starting New
Unit of content r102
    ALTPROB = et <H> sl <H>
    LSPEC = lsg
    GOALS = f <H> g <H> h <H> i <H> j <H> k <M> l <H> m <H> n
<H>
    SOC = mn <H> cq <M> cl <H>
    SITREQ = hse]

Using Classroom Dialogues and Guided Practice to Teach
Comprehension Strategies 4103
    ALTPROB = et <H> sl <H>
    QUESPROB = or <M> sl <M>
    DIRPROB = low
    LSPEC = lsr
```

```
   GOALS = l <H> m <H> n <H>
   SOC = mn <H> cq <H> rf <H>
   TLEV = el <H> jh <M>
   TAREA = la <H> sci <H> ss <H>]

Mind Mapping for Creative Problem Solving r104
   LSPEC = lsg <M> lcm <M>
   GOALS = c <H> l <H> m <M> n <M> o <M> p <M> q <M> r <M> w
<M>
   SOC = mn <H> cq <M> cl <H>
   SITREQ = scp]

Reviewing a Cumulative Folder r105
   GOALS = i <H> t <M>
   SOC = mn <H>]

Attending to Students’ Needs r106
   GOALS = c <H> w <M>
   SOC = cq <H>]

Effective Teaching Behaviors for Mainstreaming r107
   ALTPROB = et <M> at <M>
   QUESPROB = sl <M>
   LSPEC = lcm
   GOALS = l <M> n <M>
   SOC = <H>]

The Case of Phillip Becker r108
   AFFECTMODE = et <M>
   LSPEC = lms
   GOALS = c <H> l <H> n <H> w <M>
   SOC = pr <M>]

Things to Learn about Mainstreaming r109
   ALTPROB = et <M>
   LSPEC = lms
   GOALS = c <H> l <H> n <H> w <M>
   SOC =mn <H> ]

FDR’s cover up: The extent of his Handicap r110
   AFFECTMODE = p <A>
   GOALS = d <M>
   SOC = pr <M>]

Explicit Teaching of Reading Comprehension r111
   DIRPROB = low
   LSPEC = lsr
   GOALS =l <H>
   SOC = mn <H>
   TLEV = jh <H> sh <H> el <M>
   TAREA = la <H>]

Helping Readers understand Different Types of Questions r112
   QUESPROB = sl <H>
```

```
    LSPEC = lsr
    GOALS = l<H>
    SOC = MN <H>
    TLEV = el <H> jh <H>
    TAREA = la <H> ss <H> sci <H>]

Mainstreaming:  How Teachers Can Make It Work r113
    LSPEC = lms
    GOALS c <M> k <M> l <H> m <M> n <M>
    SOC =mn <H> cq <H>
    TAREA = la <H> ss <H> sci <H>]

Strategies for Teaching Students Who Have Trouble Learning
r114
    LSPEC = lsg
    GOALS = l <H> p <H> n <H>
    SOC = mn <H>]

Grading r115
    GOALS = p <H>
    SOC = mn <H>
    TLEV = jh <H> sh <H> el <H>]

Modifying Classroom Exams for Secondary LD Students r116
    LSPEC = lsg
    GOALS = l <M> p <H> q <H>
    SOC = mn <H>
    TLEV = jh <H> sh <H>]

Reducing Stress of Students in Conflict r117
    GOALS = w <H>
    SOC = cq <H> mn <M>]

Dictation: An additional students Team Learning Technique
r118
    LSPEC = lsg
    GOALS = l <M> m <M> n <M> w <M>
    SOC = mn <H> cq <M>
    TLEV = el <M> jh <H> sh <M>
    TAREA = la <H> ss <M>]

Cooperative Learning - Classroom an School r119
    LSPEC = lcm
    GOALS = l <M> m <H> w <M> c <H> n <M>
    SOC = mn <H> cq <H> rf <H>]

Facilitation at Howard County Staff Development Center r120
    ALTPROB = et <M> sl <M> at <M>
    QUESPROB = or <M> sl <M> rd <M>
    DIRPROB = low
    GOALS = h <M> j <H> k <H> m <M> n <M> q <M> r <M> w <M>
    SOC = mn <H> cl <M>]

Assessment r121
```

```
    GOALS = o <H> q <H> v <M>
    SOC mn <H>]

Art and the Exceptional Student r122
    LSPEC = lsa
    GOALS = e <M> in <M> mn <H> rf <M>
    TLEV = el <H> jh <H> sh <M>
    TAREA = art <H>]

Grouping and Special Students r123
    LSPEC lcm
    GOALS = l <M> m <H> w <M>
    SOC = mn <H> cq <H>>
    TAREA = ma <H> la  <H> ss <H> sci <H>]

Questioning Skills Information r124
    QUESPROB = info <A>
    LSPEC = lsg
    GOALS = l <H>
    SOC = mn <H>]

Mathemeatics and the Special Student r125
    LSPEC = lsm
    GOALS = l <H>
    SOC = mn <H>
    TLEV = el <H> jh <M>
    TAREA = ma <A>]

Spelling r136
    LSPEC = lsl
    GOALS l <H>
    SOC = mn <H>
    TLEV = el <H> jh <M> sh <N>
    TAREA = la <A>]

Author's chair/Peer Conferencing r127
    ALTPROB = et <M> sl <M>
    LSPEC = lsl
    GOALS = l <H> m <H> w <M>
    SOC = MN <H> CQ <H>
    TAREA = la <A>]

Dialogue Journals r128
    ALTPROB = et <M> sl <M
    LSPEC = lsl
    GOALS = l <H> w <M>
    SOC = mn <H>
    TAREA = la <A]

Assessing Arithmetic Skills and Appendix A r129
    GOALS = o <H> q <M>
    SOC = mn <H>
    TLEV = el <A>
    TAREA = m <A>]
```

```
"Learning Strategies Instruction" r131
   LSPEC = lsg
   GOALS = l <H>
   SOC =mn <H>
   TLEV = jh <H> sh <H>
   TAREA = la <H> ma <H> ss <H> sci <H>]

"Language Experience for Problem Solving in Mathematics r132
   ALTPROB = et <H> sl <M>
   DIRPROB = low
   LSPEC = lsm
   GOALS = l <H>
   SOC = mn <H.
   TLEV = el <A>
   TAREA = ma <A>]

"Using the DRA to Teach Literary Comprehension at Three
Response Levels" r134
   ALTPROB = et <H> sl <H>
   DIRPROB = low
   GOALS = n <AH>
   SOC = mn <H> cq <M>
   TLEV = sh <H> jh <M> el <N>
   TAREA = la <A>]

"Improving Reading comprehension of Disabled Readers Through
Semantic Mapping" r135
   LSPEC = lsr
   GOALS = l <AH>
   SOC = mn <H>
   TAREA = la <H> sci <H> ss <H>]

"Compensatory and Tutorial Instruction: r137
   LSPEC = lcm
   GOALS = l <H> n <M>
   SOC = mn <H.
   TLEV = jh <H> sh <H>
   TAREA = la <H> ma <H> ss <H> sci <H>]

Direct Instruction of Mathematics r144
   ALTPROB = et <M> sl <M> at <M>
   DIRPROB = low
   LSPEC = lsm
   SOC = mn <H>
   TAREA = ma <A>]

Teaching Mathematics Effectively r145
   ALTPROB = et <M> sl <M> at <M>
   DIRPROB =low
   LSPEC = lsm
   SOC = mn <H>
   TAREA =ma <A>]

Between the Deaf Child and Reading r146
```

```
   LSPEC = lsr
   GOALS = e <M> l <H.
   SOC = mn <H>
   SITREQ = chi
   TLEV = el <A>
   TAREA = la <H. ss <M> sci <M>]

Instructional Adjustments to Visio Problems r147
   LSPEC = lsg
   GOALS = l <H> o <H>
   SOC = mn <H>
   SITREQ = cvi
   TAREA = la <H. ma <H. ss <H> sci <H> ]

Language Experience Approach in Primary Science r148
   ALTPROB = sl <H> et <H.
   DIRPROB = low
   LSPEC = lsr <M> lss <M.
   GOALS = l <H.
   SOC = mn <H.
   TLEV = el <A.
   TAREA = la <H. sci <H>]

Critical Listening-Reading in Remedial Reading r149
   LSPEC = lsr
   GOALS = l <H> w <M>
   SOC =  mn <H>
   TLEV = el <A>
   TAREA = la <H>]

Viewing Reading Disability from an Interactionist's
perspective r150
   DSPEC = ld <M>
   GOALS = d <M> e <H> o <M>
   SOC = in <H> rf <H>
   PREREQ = rrr
   TAREA = la <H> ss <H> sci <H> h <H>]

Analyzing Spelling Error Patterns for Remediation r151
   GOALS = o <H>
   SOC = mn <H>
   TLEV = el <H> jh <H> sh <M>
   TAREA = la <A>]

Teaching Expositiory Text Structure r152
   LSPEC = lsg
   GOALS = l <M>
   SOC = mn <H>
   SITREQ = sig
   TLEV = el <H> jh <M> sh <N>
   TAREA = la <H> ss <M>

Listen-Read-Discuss r153
   ALTPROB = et
```

```
    DIRPROB = low
    LSPEC = lsg
    GOALS = l <H> n <M>
    SOC = mn <H>
    TLEV = jh <M> sh <H> la <H>
    TAREA = ss <H> sci <H>]

Seven Whole-Class Reading Stratgies r154
    LSPEC = lsg
    GOALS = l <H>
    SOC = mn <H>
    TLEV = jh <H> sh <H>
    TAREA = ss <H> sci <H> la <H>]

Motor Imaging: A reading-Vocabulary Strategy r155
    ALTPROB = et <H> sl <H.
    DIRPROB = low
    LSPEC = lsr
    GOALS = l <H> n <M>
    SOC = mn <H>
    TAREA = la <H> sci <H> ss <H>]

Previewing Short Stories r156
    LSPEC = lsr
    GOALS = l <H> n <M> w <H>
    SOC = mn <H>
    TAREA = la <A>]

Rate: Reason to Read r158
    LSPEC = lsr
    GOALS = l <H>
    SOC = MN <H>
    sitreq = SIG
    tlev = EL <A>
    tarea = LA <H>]

Language Intervention in Natural Settings r159
    LSPEC = lsg
    GOALS = l <M> n <M>
    SOC = mn <H>
    SITREQ = spg
    TLEV = EL <A>]

Recognizing Special Talents in LD Students r160
    AFFECTMODE = p <A.
    DSPEC = ld <M>
    GOALS = d <H> w <H>
    SOC = mn <M> rf <H>
    TLEV = sh <H> jh <M> el <N>]

Life-Size Learning Games r161
    LSPEC = lsg
    GOALS = l <H> m <H> n <H>
    SOC = mn <H>
    TLEV = el <A.
    TAREA la <H> ss <M>  ma <H>]

Song Picture Books and the Language Disabled Child r162
    LSPEC = lsg
    GOALS = l <H> n <M>
    SOC = mn <H> rf <M>
    TLEV -el <A>
    TAREA = la <H> m <H>]

Science and Life r164
    LSPEC = lss
   GOALS = l <H> n <M> m <H>
    SOC = mn <H>
    PREREQ = rcd
    TLEV = sh <A>
    TAREA `= sci <A>]

Computer-assisted Learning for hte Mildly Handicapped r165
    LSPEC = lsg
    GOALS = l <H>
    SOC = MN <H>
    SITREQ =ecp
    TLEV = el <A>
    TAREA = la <H> ma <H>]

Reading Instruction for Mildly Handicapped Adolescents r166
    LSPEC = lsr
    GOALS = l <M> o <H>
    SOC = mn <H>
    TLEV = jh <H> sh <H>
    TAREA = la <H> ss <H> sci <H>]

Learning about Disbilities r168
    GOALS = m <H>
    SOC = cq <H>
    SITREQ = scb
    TLEV = el <A>]

Self-correction for Improving Writing Skills r169
    LSPEC = lsl
    GOALS = l <H> o <M>
    SOC = mn <H>
    TAREA = la <H> ss <H> sci <H>]

Improving Comprehension r170
    LSPEC = lsl
    GOALS = l <H>
    SOC = mn <H>
    TLEV = jh <H> sh <H>
    TAREA = la <A>]

Academic Learning Time  r171
    ALTPROB = info <A>
   LSPEC = lcm
   GOALS = l <H>
   SOC = mn <H>]

Adapting Teaching to the Individual Differences of Learners
r172
   LSPEC = lms
   GOALS = l <M> e <M>
   SOC = in <M> rf <H> mn <M>
   PREREQ = rrr]

Word Processing to Improve Student Writing r173
   LSPEC = lsl
   GOALS = k <M> l <H> c <M>
   SOC = mn <H>
   SITREQ = ECP
   TAREA = la <H>]

The Hidden Minority r174
   AFFECTMODE = p <A>
   GOALS = d <H>
   SOC = pr <H> in <H>]

Ten Steps to Good Discipline r175
   GOALS = w <H>
   SOC = mn <H>]

Direct Instruction r176
   DIRPROB = info <A>
   LSPEC = lcm
   GOALS = l <H>
   SOC  = mn <H>]

Mind over Minors r177
   LSPEC = l cm
   GOALS = w <H> l <H>
   SOC = mn <H> rf <M>
   SITREQ = ecp]

Guidelines for Rewriting Text Passages r179
   GOALS = k <H>
   SOC mn <H>
   TLEV = jr <H> sh  <H>]

The Close Procedure r180
   GOALS = o <H> r <H>
   SOC = mn <H>
   TLEV = jr <H> sh <H>]

Fry Readbility Formula r181
   GOALS = k <H>
   SOC = mn <H>]

Contract Teaching r182
```

```
   GOALS = w <M> n <H> p <H>
   SOC = mn <H>]

Learning Centers r183
   ALTPROB = et <H> sl <M>
   LSPEC = lsg <M> l cm <M>
   GOALS = l <H> k <M> n <M> o <H>
   SOC = mn <H>
   TLEV = el <H> jh <H>
   TAREA = la <H>]

Vocabulary Centers r184
   ALTPROB = et <H> sl <H>
   LSPEC = lsl
   GOALS = k <M> l <H> n <M> o <H>
   SOC =mn <H>
   TLEV = el <H> jh <H>
   TAREA = la <H>]
```

Appendix J

Technical Report #202

Abductive and Deductive Inference in an Expert System for Needs Assessment in Teacher Training for Special Education

TECHNICAL REPORT #202

Abductive and Deductive Inference in an Expert System for Needs Assessment in Teacher Training for Special Education

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June, 1986

Special Project: Microcomputer-Assisted Needs Assessment System for Teacher Training in Special Education

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Abstract

This paper describes SNAP (Smart Needs Assessment Program), an expert system that selects and recommends training options for regular education teachers of mainstreamed handicapped students. SNAP is implemented using two distinct types of knowledge representation and inference mechanisms for two distinct phases of solving the problem. The first subproblem is to determine "What training does the teacher need?" A deductive inference system that represents knowledge as a series of rules provides answers to this question. These rules were derived from teacher effectiveness literature, from responses to an adaptation of the "Stages of Concern" questionnaire, from training goals teachers select for themselves, and from information about their specific teaching situation. The subproblem is to determine, "What training options are available that will meet these training needs?" A frame-based, hypothesize-and-test inference system based on abduction is used to solve this sub-problem. Training options (such as videotapes and films, local inservice workshops, journal articles, book chapters, observations of expert teachers' classrooms, etc.) are represented by descriptions, and the inference mechanism "hypothesizes" different combinations of training options until it finds ones that "cover" all a teacher's training needs with the smallest number of options. Because the abductive component of SNAP is implemented using an algorithm based on a procedure normally used for diagnostic problem solving (even though training option selection is not inherently diagnostic), extensive testing is currently being done to determine the value of using a diagnostic paradigm for a nondiagnostic problem.

The advantages of this approach to planning for teacher training over conventional approaches are discussed more fully in the paper. An expert system approach allows for analysis of individual teachers' training needs, and the selection of training programs that are uniquely suited to each teacher. Furthermore, the application of two types of inference mechanisms to solve a problem allows for expert system technology to be extended to a broader range of topics in regular and special education.

I. Introduction

This paper describes research done at the University of Maryland, Department of Special Education, on a Smart Needs Assessment Program (SNAP), an expert system combining both deductive and abductive inference to provide decision support for planning individual training programs for regular education teachers of mainstreamed handicapped students. Determining problems with other approaches for teacher training and attempting to use artificial intelligenced technology to develop a new approach were important goals of this research. One of the major efforts of the research involved the selection of knowledge representation and inference methods most suitable for the domains of research on teacher effectiveness, descriptions of training opportunities, and planning for effective training programs.

Important issues evolving from the effort include the advantages and disadvantages of using an unusual approach including both deductive and abductive inference within a single system.

II. Description of SNAP

Since 1975 when P.L. 94-142 was passed by the U.S. Congress, millions of handicapped students have been removed from isolated instructional settings and placed in mainstream classrooms. There are many educational and social advantages to this arrangement, but the problems for teachers have been substantial. Most "regular education" teachers, or teachers of mainstream classrooms have little formal training in special education *per se*, in teaching children with educational disorders, or in organizing and managing a classroom that includes some handicapped students. Formal training, however, is not necessarily a measure of an experienced teacher's skill in dealing with such a situation. In fact, some teachers adapt to the change with little difficulty, while others remain at a loss after several years with a mainstream classroom. The typical response of school districts to their teachers' needs for professional development for mainstreaming has been to offer and/or require very general courses designed to help teachers adjust to their mainstream classes and teach all their students effectively. This "shotgun" approach has some major limitations, however. First, it is inefficient, since some teachers, despite a lack of formal training, are competent at the task without additional training. Other teachers with negative attitudes toward handicapped students are unlikely to gain the skills included in the courses unless their negative affect is dealt with directly and effectively first. Secondly, the general course approach is limited in that a general course cannot help teachers with problems they need to solve immediately, or deal with specific issues that arise in unusual situations. By offering courses that attempt to please everyone, they end up pleasing no one.

SNAP addresses the shortcomings of the typical attempts to help regular education teachers become more effective teachers of mainstream classrooms by providing suggestions for training experiences selected for individual teachers based upon their attitudes toward mainstreaming and teaching handicapped students, their current skill as a classroom teacher, and their own professional goals, interests, and concerns. SNAP is an expert system that uses contextual information derived from interacting with an individual teacher, from data obtained through observation of the teacher's own classroom, from a teacher's profile on an instrument measuring the teacher's "stage of concern" about mainstreaming, and from the teacher's stated goals and interests to determine the "training needs" of the teacher by using a rule-driven deductive inference mechanism. Subsequently, these training needs are used in an abductive inference system to select from a database the most efficient set of training options that will address all the training needs for that teacher.

II. Use of Two Inference Methods in SNAP

Abduction and deduction are two inference methods commonly used in expert systems. The main distinction between them involves the concept of uncertainty. For example, suppose we have a fact, "if A, then B". If A is true, then we can deduce with absolute certainty that B is also true. On the other hand, if B is known to be true, then by abduction we can conclude that A may be true. SNAP uses both deductive and abductive inference mechanisms.

An example of the use of deduction in SNAP can be seen in the production rule in Figure 1. It is worth noting that although a deductive inference is being made, the use of a certainty factor incorporates some of the inexactness necessary in most real-world decision making. Therefore it might be argued (Charniak and McDermott, 1985) that this is an example of abduction. However, the authors of SNAP refer to this sort of inference as deduction and feel justified in doing so for two reasons. The first reason is that in the production system component of SNAP, the use of certainty factors in rules reflects lack of certainty of the source of the knowledge rather than a lack of confidence in the inferences themselves. This is a contrast to many other applications of expert systems where the expert knowledge is better defined, but more than one rule may apply for a given problem. The second reason is to distinguish this kind of inference from "true" abduction as illustrated in the next example.

---

insert figure 1 about here

"True" abduction in SNAP is best illustrated by the following example.

> Suppose there exists a training option T which addresses the needs of teacher X who has a blind student in his/her class. Then T may be a good training experience for X.

Such an inference is possible in SNAP because the training options are organized within the knowledge base as frames (see Waterman, 1986 chapter 7 for a discussion of frames) where each frame contains descriptive information for a specific training option. The knowledge representation and inference mechanisms used in SNAP will be discussed in more detail in the next section.

An examination of the attribute hierarchy will help to understand the relationship of the two parts of the total expert system to the available information and decision making processes. As Figure 2 illustrates, the total SNAP system is composed of two parts that operate separately and sequentially.

---

insert figure 2 about here

IV. Software Used In SNAP

SNAP is being implemented on an IBM PC-XT microcomputer using KES (Knowledge Engineering System), an expert system building tool which allows for both typical production systems with a backward chaining inference mechanism (see Waterman, 1986, Chapter 7 for discussions of forward and backward chaining) and frame-based knowledge bases with a not-so-typical inference mechanism based on the notion of minimal set covering. (Reggia, Nau & Wang,1983) The subsystem for building production systems is called KES.PS, and the subsystem for building frame-based expert systems is called KES.HT (hypothesize-and-test). Due to the current unavailability of KES.HT for microcomputers, the frame-based component of SNAP is now written using KMS.HT, a software package developed at the University of Maryland which is the predecessor of KES.HT (Reggia & Perricone, 1982).

The minimal set covering model for diagnostic problem solving is illustrated by Figure 3. Let D be a set of disorders and M be a set of manifestations. Typically, D would correspond to diseases and M would correspond to symptons. Furthermore, a causal relationship exists between D and M such that for every disorder d in D, the subset of M containing all manifestations caused by d is known. The objective of minimal set covering is, given a subset of M of manifestations present, to find all minimal subsets of D such that all present manifestations are "covered", i.e., are caused by at least one disorder in the subset of D (Reggia et al, 1983). KMS.HT (and KES.HT) uses an inference method based on this notion of minimal set covering.

---

insert Figure 3 about here

It should be clear that the inference mechanisms of KES.PS and KES.HT involve deduction and abduction respectively. The inference mechanism of KES.HT involves a repetetive process which keeps track of a subset of D covering the currently known manifestations and modifies that subset as new manifestations are discovered by means of questioning the user (Reggia & Perricone, 1982; Reggia et al, 1983).

V. Abduction and Deduction in SNAP

Conceptually, SNAP can be thought of as two expert systems. One system determines training needs for teachers on the basis of classroom observations, their subject areas, the achievement level of their students, and other data. The other expert system prescribes training options to "cover" the training needs determined by the first system, using information regarding the teacher's role, experience level, and chosen learning goals as additional input. Based on the tips for choosing an inference mechanism in KES (Software Architecture & Engineering, 1986) a rule-based deductive approach was selected for the first system and a frame-based abductive approach was selected for the second system.

The purpopse of this deductive knowledge base is to determine the values of TES (Teacher Effectiveness Scale) which uses information obtained from observations to determine how effective the teacher is in the areas of providing the appropriate amount of direct instruction (DIR), assuring an adequate amount of academic learning time (ALT), and providing all students with adequate opportunities to respond to questions successfully (QUES).

The rules for determining the level of teaching skill indicated by the observation data were derived from recent research on teacher and school effectiveness (Wittrock, 1986). Additional training needs come from an algorithm analyzing teachers' responses to an instrument called the "Stages of Concern About Mainstreaming" (SOC), and from teachers' responses to a questionnaire about their interests and goals for their own professional development related to mainstreaming (GOALS).

A rule-based approach was used to determine training needs for several reasons. The knowledge to be incorporated into the knowledge base naturally exists as research reports published in professional journals and technical reports. With some exceptions, the _Handbook of Research on Teaching_ (Wittrock, 1986) reports summaries of much of this research literature. These reports typically describe populations, settings, independent and dependent variables in some detail. These descriptive data enable the knowledge base author to define attributes and their values, and the research results are used to determine antecedent-consequent relationships that are written as production rules. Combinations of attributes not specifically covered by research studies and conflicting results were written into production rules by considering the consistency and general direction of findings of the research literature in a holistic sense. Reduced certainty factors reflect the degree to which a rule is removed from actual research findings. These procedures result in a fairly natural form of representation for the knowledge.

Another factor favoring the use of rules is a low level of context dependence; i.e., the value of an inferred attribute is influenced by the values of a relatively small number of other attributes. Although many of the inferred attributes in the rule-based component of SNAP meet this requirement, the direct instruction ratio (DIR) categorization is a notable exception, and created some difficulties which will be discussed in a subsequent section.

The second part of the SNAP system, the abductive part, uses training needs and data concerning contextual factors affecting the selection of training options to select the actual set of training options that will be recommended for an individual teacher. KES.HT uses the principle of minimality to select the smallest number of separate training options that will "cover" all the training needs for an individual teacher. Contextual information, called "setting factors" in this case, is used to select only those options that meet the contextual requirements for a given training option, but are not "needs" that the selection must "cover." For example, if a given teacher teaches a third grade class, training options geared for an elementary teacher rather than a high school teacher would be appropriate; however being a third grade teacher is not a training need itself, but a factor limiting which options should be recommended.

The training options selection component of SNAP differs from the training needs assessment component in several ways and, therefore, a frame-based representation and abductive inference mechanism were chosen. Unlike the data on teacher effectiveness, the training options used in SNAP exist as a database, where each record describes a training option. Therefore, the knowledge to be encoded preexists in a frame-like format. Also, the classification of training options is not primarily categorical. In fact, there is a lot of overlap between the training options in the sense that several of them may address similar training needs, although some may serve "better" than others. Finally, the training options selection process is heavily context dependent in that selection of a given training option typically depends on a fairly large number of training needs as well as additional factors, such as the teacher's experience level, subject, and grade level. Hence, the number of rules needed to encode training options selection would be prohibitively large, considering that SNAP currently uses a database of well over 200 training options. All of these factors favor the use of a frame-based knowledge representation and a hypothesize-and-test inference mechanism over the use of production system.

At this point, one might ask the question, "Why not use a database management system for selecting the training options?" There are two principal reasons why not. First, a DBMS is "dumb"; it does not know when to stop asking questions. For SNAP, an "intelligent" program capable of asking only what it needs to know in order to make an intelligent selection is desired. For example, let us assume that after asking a series of questions SNAP has narrowed the choice of training options for a teacher down to a small number, all of which are appropriate for any experience level. It then follows that it is unnecessary for SNAP to know the teacher's experience, so it should not be asked. Thus a "smart" question generating process is required.

The second reason for not using a DBMS relates to the principle of parsimony. Since many of the training options in SNAP cover similar training needs, it is quite probable that a large number of training options will be appropriate for a typical teacher. However, it is more desirable to limit the number prescribed to only a few due to economic considerations as well as time constraints on the part of the teacher. KMS.HT fulfills this goal by always selecting the smallest number of training options possible which can address all of the training needs present. Unfortunately, this solution results in a lack of flexibility which will be discussed in the next section.

Another advantage of using abductive inference in this system is its simplicity. Figure 4 illustrates a case where a training option description includes all the information that it would require more than 40 rules to cover. This efficiency is typical of cases where there are many contextual variables that would need to be systematically varied, since all possible values for all attributes would have to be included.

----

insert figure 4 about here

VI. Problems

One of the problems with using a deductive inference system is the "explosion" of rules when numerous contextual factors are needed to contribute to the decision-making process. Figure 1 is an example of one rule which indicates its limited applicability when the contextual features vary. The particular piece of research upon which this rule was based includes two important contextual limitations of the findings, "grade" and "SES". However, the body of teacher effectiveness research as a whole indicates that the amount of direct instruction that is appropriate for students varies depending upon the age and socio-economic status of the students (as indicated by the rule in Figure 1), but also depends upon the subject matter being taught and the goals the teacher has for the students. By expanding rules based directly on research, such as this one, to include contextual variables found to be important in other, related research, additional rules are derived that cover as many different values for the contextual features as possible. In the case of the DIR portion of the SNAP system, which is but a small part of it, fifteen original rules "exploded" into 176 in the most recent version of the system. This explosion makes the knowledge base too large to be tested and maintained easily, and diminishes the directness of the relationship between the research literature and the production rules because the research base is incomplete.

Another problem occurs as a result of the "minimality" principle incorporated in the abductive portion of the SNAP system. According to this principle of minimality, KES.HT will select the smallest number of training options that cover all the training needs of an individual teacher. In the case of training, however, it is not at all clear that the smallest number of training options is the most desirable. The result of such a process could be the selection of one "shotgun approach" course, exactly the option that SNAP is designed to avoid. Since a general course is designed to cover all topics for all grade levels, all subject areas, all types of handicaps, etc., its description would cover all those features, and hence would allow it to be selected as one single training option that will satisfy a teacher's training needs. In selecting and coding training options, SNAP's knowledge engineers have usually avoided including such general options in the knowledge base, preferring to focus on options addressing more specific needs.

As mentioned earlier, the minimality requirement for KMS.HT causes some major problems. Perhaps the most apparent of these shortcomings is simply that for SNAP, minimality is not really preferable. Although minimizing the size of the cover for a teacher's training needs is desirable, it is also desirable to give a teacher multiple training options covering the same training need where the additional training would benefit the teacher. A solution to this problem would be to use some criterion other than minimality to keep the number of training options selected small. Computer scientists concerned with this area are currently seeking alternatives to currently used methods. (Peng 1986, Chu 1985)

Another problem caused by minimality is that often non-specific "shotgun" training options which cover a lot of training needs but not very well are favored by KMS.HT over training options that are specifically geared toward a single training need. Again the only truly satisfactory solution to this problem would be to alter the KMS.HT algorithm. As a compromise solution, the criteria for a training option to cover a training need was strengthened in order to decrease the number of weak "shotgun" training options in the knowledge base.

Perhaps the most important issue concerning SNAP is that it is an attempt at using a diagnostic problem solving paradigm to solve a non-diagnostic problem. This attempt to apply abductive diagnostic inference to a non-diagnostic problem is also being studied in the area of natural language processing (Dasigi & Reggia, 1986). The SNAP system equates training options with "diseases" and training needs with "symptoms" even though it is not clear that such a relationship is valid. It should be pointed out that the non-diagnostic nature of SNAP is really the root of the difficulties previously mentioned with respect to the minimality issue. Whereas minimality is a reasonable and even sensible requirement in applications such as medical diagnosis, it does not seem to be optimal for SNAP. With more testing it will be determined whether or not training option selection in SNAP can be satisfactorily implemented using the diagnostically motivated parsimonious covering principle.

VII. Future Testing of SNAP

The SNAP system is currently in its final phase of development and testing. Although the individual components of the system have been field tested, a full-scale test has not yet been conducted. It should be remembered that the current implementation of SNAP is experimental. Questions regarding the feasibility of using microcomputer-based expert systems for education, the relative effectiveness of deductive and abductive systems, and the quality of performance of such systems in education are of importance. In addition, the knowledge engineering procedures needed to transform the existing research literature into a knowledge base are being explored and questioned.

To answer these questions, 26 experienced regular education teachers who have mainstream classrooms and are enrolled in a Master's Degree program in Curriculum and Instruction are using SNAP within the context of a special education course on mainstreaming. Unlike future users of SNAP, however, a project staff member is present while they are using the system to document their comments, difficulties, etc. in using the system. Another modification made for this test period is that teachers' data is being recorded both on a diskette, and on the hard disk of the computer. In the final implementation data will only be recorded on the diskette so that the privacy of individual teachers' information is maintained. In this testing of SNAP, however, the data recorded on the hard disk will be used to compare the training options selected by SNAP with those recommended by teacher education experts who will use teachers' data for this selection process. Project staff members will interview the teachers when the training options have been recommended, and after the teachers have participated in them. In this way, information concerning teachers' attitudes toward the selected training options, their perceived relevance to specific teachers, and the accuracy of their content and description in the knowledge base can be ascertained.

VIII. Conclusion

Using KES (and, temporarily KMS) has enabled the development of an extensive expert system combining the advantages of a rule-based deductive component with a frame-based abductive component. In this SNAP application, relying on either one alone would have been nearly impossible. The disadvantages of the two subsystems became apparent when the research resulted in the generation of a deluge of rules, and when the principle of minimality required the careful scrutiny and revision of training options in the knowledge base.

It is clear that for this application, as well as others that rely on highly contextualized information and complex interrlationships among alternatives to be selected, abduction is a useful, if not necessary, tool for incorporating expert knowledge into a functioning expert system. In educational settings which require the consideration of complex relationships among student, teacher, classroom, school, and numerous other variables, abductive frame-based systems allow for simultaneous consideration of all variables relevant to a decision that may have a major impact on a student's schooling. Relying on deductive rule-based systems alone would require systems of an unwieldy size, and would result in large numbers of single recommendations without regard for effective combinations of alternatives. Further researach is currently under way to combine deduction and abduction in other expert system implementations for educators.

References

Charniak, E., and McDermott, D.(1985). Introduction to Artificial Intelligence, Addison-Wesley, Reading, MA.

Chu, B. (1985). ABLOG/IC: A programming language supporting abductive problem solving. Technical Report TR-1526, University of Maryland, Department of Computer Science.

Coulson, D. Malouf, D.B. and Haynes, J.A.(1985) Adapting the stages of concern about innovation questionnaire to measure teacher attitudes about mainstreaming. Technical Report #201, University of Maryland, Institute for the Study of Exceptional Children and Youth.

Dasigi, V., and Reggia, J. (in press) Abduction in discourse processing: A parsimonious covering model. Proceedings of the Symposium on the Role of Language in Problem Solving-II. Johns Hopkins University.

Haynes, J. (1985). The application of artificial intelligence and expert systems to the referral, diagnosis, and instructional planning processes. Technical Report #401, University of Maryland, Institute for the Study of Exceptional Children and Youth.

Malouf, D.B. (1983). Project overview: Systematic needs assessment program: A computer-assisted needs assessment system for teacher training in special education. Technical Report #200, University of Maryland, Institute for the Study of Exceptional Children and Youth.

Peng, Y. (1986). A formalization of parsimonious covering and probabilistic reasoning in abduction and diagnostic inference. Technical Report TR-1615, University of Maryland, Department of Computer Science.

Ramsey, C.L., Reggia, J.A., Nau, D.S. and Ferrentino, A. (in press) A comparative analysis of methods for expert systems. International Journal of Man-Machine Studies.

Reggia, J.A., Nau, D.S. and Wang, P.Y. (1983). A theory of abductive inference in diagnostic expert systems. Technical Report TR-1338, University of Maryland, Department of Computer Science.

Reggia, J.A., Nau, D.S., and Wang, P.Y. (1985). A formal model of diagnostic inference: Problem formulation and decomposition. Information Sciences 37, 227-256.

Reggia, J.A., and Perricone, B. (1982). KMS manual. Technical Report TR-1136, University of Maryland, Department of Computer Science.

Software Architecture and Engineering (1985). Knowledge Engineering System: Knowledge Base Author's Manual, Software Architecture and Engineering, Arlington, VA.

Waterman, D.A. (1986). A Guide to Expert Systems. Addison-Wesley, Reading, MA.

Footnote

[1] The rule-based component of SNAP is implemented on a microcomputer using KES (Software Architecture and Engineering, 1985), an expert system authoring tool. Due to the current unavailability of the frame-based component of KES for microcomputers, this part of SNAP is implemented using KMS (Reggia and Perricone, 1982), an experimental predecessor to KES.

Appendix K

Rules in the Teacher Effectiveness Expert System

```
type
\snapkb

text:
        {certification: "This knowledge base determines training",
        "needs related to the teacher effectiveness literature",
        "on academic learning time, questioning skill, and direct",
        "instruction.  It was written in 1985 by Jackie Haynes and",
        "revised and enlarged by Jackie Haynes and Jennie Pilato",
        "in January, 1986."}

        {certainties:  "Certainty factors were determined by following",
        "the following rules:  If a substantial piece of research was",
        "used to write a rule and all elements embodied in the resarch",
        "are contained in the rule, the certainty factor assigned is 1.0.",
        "If the rule was derived from another rule with a certainty factor",
        "of 1.0 by changing one attribute, the certainty factor is reduced",
        "by 0.1.  For each additional change to the original rule, another",
        "0.1 is subtracted from the certainty factor for that rule.  It is",
        "therefore possible to determine how far removed a rule is from the",
        "original research upon which it was based by examining its",
        "certainty factor."}

        {reference1:  "Anderson & Scott, 1978"}
        {reference2:  "Brophy, 1983"}
        {reference3:  "Brophy & Good, 1986"}
        {reference4:  "Centra & Potter, 1980"}
        {reference5:  "Emans, 1983"}
        {reference6:  "Evertson, 1980"}
        {reference7:  "Fisher, Berliner, Filby, Marliave, Cahen, & Dishaw",
                      "1978"}
        {reference8:  "Good & Grouws, 1979"}
        {reference9:  "Medley & Crook, 1980"}
        {reference10: "Peterson, 1979"}
        {reference11: "Rieth, Polsgrove, & Semmel, 1981"}
        {reference12: "Rosenshine, 1980"}
        {reference13: "Rosenshine, 1983"}
        {reference14: "Rosenshine, 1986"}
        {reference15: "Souster, 1982"}
        {reference16: "Stallings, 1976"}
        {reference17: "Stallings & Kaskowitz, 1974"}
%

attributes:

 alloctm: real
        [constraint:  alloctm ge 0.0 and alloctm le 600.0]
        {explain:  "Allocated time is the total amount of time that COULD",
        "be used for instruction.  It excludes time used for recess, lunch,",
        "school plays, transition from one class to another, etc. "}
        {definition: "The amount of time students are in their classroom in a",
                "given school day"}.


teachtm:  real
        [constraint:  teachtm ge 0.0 and teachtm le 600.0]
        {definition:  "Teaching time is the amount of time a teacher",
                " spends providing direct instruction to the entire",
                "class or a subgroup of the class in a given school day."}.

DIR:  real
        [constraint:  DIR  ge 0 and DIR  le 1.0]
        [calculation:  teachtm/alloctm]
        {definition:  "the proportion of time available for direct",
         " instruction  that is actually used for that purpose"}.

DIRval: mlt
        (high, medium, low)
        {definition: "the evaluation of the teacher's reported data on",
                "the amount of direct instruction provided in the classroom,",
                "considering other variables that affect what this value",
                 "should be"}.

SES:  sgl
        (poor, middle class, upper class)
        {question:  "What is the socio-economic status of your students?"}
        {definition: "the general socio-economic status of the majority of",
                     " the students in a given classroom"}.

Tarea: mlt
        (mathematics,
         English
{question:  "English (including study skills and reading)"},
         reading
                {question:  "reading (at the elementary level)"},
         language arts,
         science,
         social studies,
         art,
         music,
         physical education,
         home economics,
         foreign language,
         health education,
         industrial arts,
         special education {explain:  "Special Education, any grade level"},
         other)
{question:  "What subject do you teach?"}
        {definition:  "specific skill and/or content areas you teach, or," ,
                      "if you are a generalist, any areas that you ",
                      "specialize in"}.

science focus: sgl
        (labs, lecture
                {question:  "lecture and demonstration"},
         discussion)
        {question:  "What form of instruction in science is most like ",
                "what you were doing during the self observations?"}.

tlevel: sgl
        (primary
                {question: "Kindergarten thru Grade 3"},
        intermediate
                {question: "Grades 4 thru 6"},
        junior high
                {question: "Any grade in a school including grades 6 thru 9"},
        high school
                {question: "Any  grade in a school including 9 thru 12"})
        {question:  "What level do you teach?"}
        {definition:  "The level at which you are assigned (not the",
            "instructional level of your students) to teach most of",
            "the time."}.

Tgoal: sgl
        (tests {question: "improving achievement as reflected in",
        " standardized test scores"},
         self concept {question:  "enhancing students' self concept"},
         school attitude {question:  "improving students attitudes",
                " toward school"},
          creativity {question:  "improving students creative thinking",
                 " and problem solving"})
        {question:  "What is your most important teaching goal?"}.

achlevel:  mlt
        (high, average, low)
        {question: "What is the achievement level of most of your students?"}
        {definition:  "The achievement level of your students relative to",
        "             national norms on achievement tests."}.


reading skills: mlt
        (beginnning rdg
        {question:  "beginning reading skills (decoding, phonics,",
                    " letter recognition)"},
        basic skills
        {question:  " basic skills in reading (phonics, syllabication, ",
                    "prefixes & suffixes, root words, etc.)"},
        vocabulary
        {question:  "learning to recognize, use, and/or spell new words "},
        comprehension
        {question:  "developing the ability to understand text at literal,",
                    "inferential, and problem solving levels"})
        {question:  "What reading skills were you teaching during the",
                    "time you were conducting the self observation ?"}.

language skills:  mlt
        (oral expression
        {question:  "oral expression (giving oral reports, speeches, etc.)"},
         grammar
        {question:  "grammar (subject-verb agreement, parts of speech,",
                    "types of sentences, correct usage, etc.)"},
         language mechanics
        {question:  "mechanics of written language (capitalization,",
                    " punctuation, etc."},
          writing
        {question:  "writing, including creative and expository writing"})
        {question:  "What language arts skills were you teaching during the",
                    "time you were conducting the self observation?"}.

DIRprob:  sgl
        (none, high, low)
        {explain:  "DIRprob means there is a problem with DIR and the",
                   "value high or low indicates the direction of the",
                   "problem."}.

%

externals:
        allocatedtime:
                [program: "timal"]
                [outputs: alloctm]
                [outputfile: "timal.dta"].
        teachingtime:
                [program: "timtc"]
                [outputs: teachtm]
                [outputfile: "timtc.dta"].
%

rules:

DIRother1:
        if
        tlevel = primary  ¦ intermediate
        and Tgoal # tests
        and DIR ge 0.8
```

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```
        then
        DIRval = low <0.6> .
        message "If you are trying to improve your students' creativity",
        "problem solving skills, attitude toward school, or self concept,",
        "it would be better to use less direct instruction and allow more",
        "time for other types of activities.".
        endif.

DIRother2:
        if
        tlevel = primary  ¦ intermediate
        and Tgoal # tests
        and DIR lt 0.8
        and DIR ge 0.5
        then
        DIRval = medium  <0.6> .
        message "If you are trying to improve your students' creativity",
        "problem solving skills, attitude toward school, or self concept,",
        "it would be better to use less direct instruction and allow more",
        "time for other types of activities.".
        endif.

DIRother3:
        if
        tlevel = primary  ¦ intermediate
        and Tgoal # tests
        and DIR lt 0.5
        and DIR ge 0.33
        then
        DIRval = high  <0.6> .
        message "If you are trying to improve your students' creativity",
        "problem solving skills, attitude toward school, or self concept,",
        "you are giving them some direct instruction, which is essential,",
        "but you are also doing lots of other types of activities which are",
        "better than direct instruction for promoting your major goals.".
        endif.

DIR1a:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and SES = poor
        and achlevel = low
        and DIR ge 0.8
        then DIRval = high <0.9>.
        message "You are conducting a great deal of direct instruction",
                "in your classroom.  This is a sound instructional practice.",
                "Research indicates the importance of providing a high",
                "amount of direct instruction with low achievement students",
                "and with low SES students.",
                " ".
        display attach reference5 of kb.
        display attach reference8 of kb.
        endif.

DIR1b:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR ge 0.8
        then DIRval = high <0.7>.
        message "You are conducting a great deal of direct instruction",
                "in your classroom.  This is a sound instructional practice.",
                "Research indicates the importance of providing a high amount",
                "of direct instruction with low achievement students. ',
                " ".
        display attach reference5 of kb.
        display attach reference8 of kb.
        endif.

DIR1c:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and SES = poor
        and achlevel = average
        and DIR ge 0.8
        then DIRval = medium <0.7>.
        message "You are providing a great deal of direct instruction in your",
                "math class.  However, you may help average students improve",
                "their achievement by reducing direct instruction somewhat,",
                "thereby allowing more time for independent seatwork.",
                " ".
        display attach reference15 of kb.
        endif.

DIR1d:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and achlevel = high
        and DIR ge 0.8
        then DIRval = low <0.9>.
        message "You are providing your high achievement students with more",
                "direct instruction than they require in mathematics.  They",
                "may benefit from having more time in class for independent",
                "seatwork.",
                " ".
        display attach reference15 of kb.
        endif.

DIR1e:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and SES =  middle class ¦ upper class
        and achlevel = average
        and DIR ge 0.8
        then DIRval = high <0.7>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                " ".
        display attach reference5 of kb.
        endif.
\**********


DIR1a1:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        or Tgoal = tests
        and SES = poor
        and achlevel = low
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        DIRprob = low.
        message "You are providing a moderate amount of direct instruction.",
                "A higher amount is important for helping students develop",
                "basic skills.  Your students will benefit from frequent but",
                "brief periods of guided practice.",
                " ".
        display attach reference3 of kb.
        display attach reference8 of kb.
        endif.

DIR1b2:

        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.6>.
        DIRprob = low.
        message "You are providing a moderate amount of direct instruction.",
                "A higher amount is important for helping students develop",
                "basic skills.  Your students will benefit from frequent but",
                "brief periods of guided practice.",
                " ".
        display attach reference3 of kb.
        display attach reference8 of kb.
        endif.

DIR1c3:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and SES = poor
        and achlevel = average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.6>.
        message "You are providing a moderate amount of direct instruction.",
                "A higher amount is important for helping students develop",
                "basic skills.  Your students will benefit from frequent but",
                "brief periods of guided practice.",
                " ".
        display attach reference3 of kb.
        display attach reference8 of kb.
        endif.

DIR1d4:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and achlevel = high
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "For high achievement students, less direct instruction is",
                "recommended so that students have adequate time for",
                "independent seatwork.",
                " ".
        display attach reference15 of kb.
        endif.

DIR1e5:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and SES = middle class ¦ upper class
        and achievel - average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.7>.
        message "You are providing a moderate amount of direct instruction.",
                "A higher amount is important for helping students develop",
                "basic skills.  Your students will benefit from frequent but",
                "brief periods of guided practice.",
                " ".
        display attach reference3 of kb.
        display attach reference8 of kb.
        endif.

DIR1f6:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and SES = poor
        and achlevel = low
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = low <0.7>.
        message "You are providing a low amount of direct instruction.  To",
                "improve your students' math achievement, you should provide",
                "a lot more direct instruction.  Your students will benefit",
                "from frequent but brief periods of guided practice.",
                " ".
        display attach reference3 of kb.
        display attach reference8 of kb.
        endif.

DIR1g7:

        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = medium <0.5>.
        message "You are providing a low amount of direct instruction.  To",
                "improve your students' math achievement, you should provide",
                "more direct instruction.",
                " ".
        display attach reference3 of kb.
        display attach reference8 of kb.
        endif.

DIR1h8:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and SES = poor
        and achlevel = average
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = low <0.5>.
        message "You are providing a low amount of direct instruction.  To",
                "improve your students' math achievement, you should provide",
                "alot more direct instruction.  Your students will benefit",
                "from frequent but brief periods of guided practice.",
                " ".
        display attach reference3 of kb.
        display attach reference8 of kb.
        endif.
```

```
DIR1i9:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and achlevel = high
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval =  high <0.9>.
        message "The amount of direct instruction you are providing your",
                "high achievement students is low but appropriate.  It is",
                "important to give them time for independent seatwork.",
                " ".
        display attach reference15 of kb.
        endif.

DIR1j10:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = low <0.7>.
        message "You are providing a low amount of direct instruction.  To",
                "improve your students' math achievement, you should provide",
                "more direct instruction.",
                " ".
        display attach reference3 of kb.
        display attach reference8 of kb.
        endif.

DIR1k11:
        if
        tlevel = primary ¦ intermediate
        and Tarea = mathematics ¦ music
        and DIR lt 0.5
        then DIRval = low.
        message "Direct instruction is important in the teaching of basic",
                "skills.  If you are not providing direct instruction at",
                "least half of most of your math classes, your students are",
                "not receiving enough direct instruction.",
                " ".
        display attach reference8 of kb.
        endif.

DIR1fa:
        if tlevel = primary
        and Tarea = reading
        and reading skills # comprehension
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.8
        then DIRval = high <0.8>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "The high amount of direct instruction is particularly",
                "important when basic skills are being taught.",
                " ".
        display attach reference5 of kb.
        display attach reference9 of kb.
        endif.
DIR1fb:
        if tlevel = primary
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.8
        then DIRval = high <0.8>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "The high amount of direct instruction is particularly",
                "important when basic skills are being taught.",
                " ".
        display attach reference5 of kb.
        display attach reference9 of kb.
        endif.

DIR1ga:
        if tlevel = intermediate
        and Tarea = reading
        and reading skills # comprehension
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.8
        then DIRval = medium <0.8>.
        message "You are using an extremely high amount of direct instruc-",
                "tion, which is important when teaching basic skills.",
                "However, with intermediate students a more moderate amount",
                "of direct instruction is appropriate.",
                " ".
        display attach reference14 of kb.
        endif.

DIR1gb:
        if tlevel = intermediate
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.8
        then DIRval = medium <0.8>.
        message "You are using an extremely high amount of direct instruc-",
                "tion, which is important when teaching basic skills.",
                "However, with intermediate students a more moderate amount",
                "of direct instruction is appropriate.",
                " ".
        display attach reference14 of kb.
        endif.

DIR1h:
        if tlevel = primary
        and Tarea = language arts
        and language skills # writing
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.8
        then DIRval = high <0.8>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "The high amount of direct instruction is particularly",
                "important when basic skills are being taught.",
                " ".
        display attach reference5 of kb.
        display attach reference9 of kb.
        endif.

DIR1i:
        if tlevel = intermediate
        and Tarea = language arts
        and language skills # writing
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.8
        then DIRval = medium <0.8>.
        message "You are using an extremely high amount of direct instruc-",
                "tion, which is important when teaching basic skills.",
                "However, with intermediate students a more moderate amount",
                "of direct instruction is appropriate.",
                " ".
        display attach reference14 of kb.
        endif.

DIR1j:

        if tlevel = primary
        and Tarea = reading
        and reading skills = comprehension
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.8
        then DIRval = medium <0.7>.
        message "You are providing an extremely high amount of direct",
                "instruction.  Your amount of direct instruction is some-",
                "what too high when teaching higher level skills, including",
                "reading comprehension.  Direct instruction of comprehension",
                "skills should be accompanied by adequate time for silent",
                "reading.",
                " ".
        display attach reference14 of kb.
        display attach reference15 of kb.
        endif.

DIR1k:
        if tlevel = intermediate
        and Tarea = reading
        and reading skills = comprehension
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.8
        then DIRval = medium <0.8>.
        message "You are providing an extremely high amount of direct",
                "instruction.  Your amount of direct instruction is some-",
                "what too high when teaching higher level skills, including",
                "reading comprehension.  Direct instruction of comprehension",
                "skills should be accompanied by adequate time for silent",
                "reading.",
                " ".
        display attach reference14 of kb.
        display attach reference15 of kb.
        endif.

DIR1L:
        if tlevel = primary
        and Tarea = language arts
        and language skills = writing
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.8
        then DIRval = medium <0.6>.
        message "You are providing an extremely high amount of direct",
                "instruction.  Your amount of direct instruction is somewhat",
                "too high when teaching writing.  Direct instruction of",
                "writing skills should be accompanied by adequate time for",
                "the practice of writing.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1m:

        if tlevel = intermediate
        and Tarea = language arts
        and language skills = writing
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.8
        then DIRval = low <0.7>.
        message "You are providing an extremely high amount of direct",
                "instruction.  Your amount of direct instruction is somewhat",
                "too high when teaching writing.  Direct instruction of",
                "writing skills should be accompanied by adequate time for",
                "the practice of writing.  Intermediate students require a",
                "high amount of time for planning what they will write as well",
                "as for writing.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1na:
        if
        tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills # comprehension
        and SES = poor
        and achlevel = low
        and DIR ge 0.8
        then DIRval = high <0.8>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "The high amount of direct instruction is particularly",
                "important when basic skills are being taught.",
                " ".
        display attach reference5 of kb.
        display attach reference9 of kb.
        endif.
DIR1nb:
        if
        tlevel = primary ¦ intermediate
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and SES = poor
        and achlevel = low
        and DIR ge 0.8
        then DIRval = high <0.8>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "The high amount of direct instruction is particularly",
                "important when basic skills are being taught.",
                " ".
        display attach reference5 of kb.
        display attach reference9 of kb.
        endif.


DIR1o:
        if
        tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills = comprehension
        and SES = poor
        and achlevel = low
        and DIR ge 0.8
        then DIRval = high <0.8>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "Comprehension instruction with low achievement students",
                "should focus on direct instruction of comprehension",
                "strategies.",
                " ".
        display attach reference5 of kb.
        endif.

DIR1p:
        if
        tlevel = primary ¦ intermediate
        and Tarea = language arts
        and language skills # writing
        and SES = poor
        and achlevel = low
        and DIR ge 0.8
        then DIRval = high <0.8>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                " ".
        display attach reference3 of kb.
        display attach reference5 of kb.
        endif.

DIR1q:
        if
        tlevel = primary ¦ intermediate
        and Tarea = language arts
        and language skills = writing
        and SES = poor
        and achlevel = low
        and DIR ge 0.8
        then DIRval = low <0.7>.
        message "You may help your students improve their writing by reducing",
                "the amount of direct instruction.  They need more class time",
                "to develop writing skills through practice.",
                " ".
        display attach reference10 of kb.
        endif.


DIR1ra:
        if
        tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills # comprehension
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR ge 0.8
        then DIRval = high <0.6>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                " ".
        display attach reference5 of kb.
        endif.


DIR1rb:
        if
        tlevel = primary ¦ intermediate
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR ge 0.8
        then DIRval = high <0.6>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                " ".
        display attach reference5 of kb.
        endif.


DIR1s:
        if
        tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills = comprehension
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR ge 0.8
        then DIRval = high  <0.6>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "Comprehension instruction with low achievement students",
                "should focus on direct instruction of comprehension",
                "strategies.",
                " ".
        display attach reference5 of kb.
        endif.

DIR1t:
        if
        tlevel = primary ¦ intermediate
        and Tarea = language arts
        and language skills # writing
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR ge 0.8
        then DIRval = high <0.7>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                " ".
        display attach reference3 of kb.
        display attach reference5 of kb.
        endif.

DIR1u:
        if
        tlevel = primary ¦ intermediate
        and Tarea = language arts
        and language skills = writing
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR ge 0.8
        then DIRval =  low <0.6>.
        message "You may help your students improve their writing by reducing",
                "the amount of direct instruction.  They need more class time",
                "to develop writing skills through practice.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1va:
        if
        tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills # comprehension
        and SES = poor
```

```
          and achlevel = average
          and DIR ge 0.8
          then DIRval = high <0.6>.
          message "You are conducting a great deal of direct instruction in",
                  "your classroom.  This is a sound instructional practice.",
                  " ".
          display attach reference5 of kb.
          endif.

DIR1vb:
          if
          tlevel = primary ¦ intermediate
          and Tarea # reading ¦ mathematics ¦ language arts
          and Tgoal = tests
          and SES = poor
          and achlevel = average
          and DIR ge 0.8
          then DIRval = high <0.6>.
          message "You are conducting a great deal of direct instruction in",
                  "your classroom.  This is a sound instructional practice.",
                  " ".
          display attach reference5 of kb.
          endif.

DIR1w:
          if
          tlevel = primary ¦ intermediate
          and Tarea = reading
          and reading skills = comprehension
          and SES = poor
          and achlevel = average
          and DIR ge 0.8
          then DIRval = medium <0.5>.
          message "Your amount of time for direct instruction is quite high.",
                  "For average achievement students it will be helpful to",
                  "reduce direct instruction somewhat, allowing them more class",
                  "time for silent reading.",
                  " ".
          display attach reference3 of kb.
          display attach reference14 of kb.
          endif.

DIR1x:
          if
          tlevel = primary ¦ intermediate
          and Tarea = language arts
          and language skills # writing
          and SES = poor
          and achlevel = average
          and DIR ge 0.8
          then DIRval = high <0.6>.
          message "You are conducting a great deal of direct instruction in",
                  "your classroom.  This is a sound instructional practice.",
                  " ".
          display attach reference5 of kb.
          endif.

DIR1y:
          if
          tlevel = primary ¦ intermediate
          and Tarea = language arts
          and language skills = writing
          and SES = poor
          and achlevel = average
          and DIR ge 0.8
          then DIRval = low <0.5>.
```

```
        message "You may help your students improve their writing by reducing",
                "the amount of direct instruction.  They need more class time",
                "to develop writing skills through practice.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1za:
        if
        tlevel = primary
        and Tarea = reading
        and reading skills # comprehension
        and achlevel = high
        and DIR ge 0.8
        then DIRval = high <0.8>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "The high amount of direct instruction is particularly",
                "important when basic skills are being taught.",
                " ".
        display attach reference5 of kb.
        display attach reference9 of kb.
        endif.

DIR1zb:
        if
        tlevel = primary
        and Tarea = language arts
        and language skills # writing
        and achlevel = high
        and DIR ge 0.8
        then DIRval = high <0.8>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "The high amount of direct instruction is particularly",
                "important when basic skills are being taught.",
                " ".
        display attach reference5 of kb.
        display attach reference9 of kb.
        endif.

DIR1zc:
        if
        tlevel = primary
        and  Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and achlevel = high
        and DIR ge 0.8
        then DIRval = high <0.8>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "The high amount of direct instruction is particularly",
                "important when basic skills are being taught.",
                " ".
        display attach reference5 of kb.
        display attach reference9 of kb.
        endif.

DIR1aa:
        if
        tlevel = intermediate
        and Tarea = reading
        and achlevel = high
        and DIR ge 0.8
        then DIRval = low <0.7>.
        message "Your amount of direct instruction is very high.  Reducing",
                   "this amount to a low level should help high achievement",
                   "students in intermediate reading.  They need more time to",
                   "read.",
                   " ".
        display attach reference10 of kb.
        display attach reference15 of kb.

        endif.

DIR1bb:
        if
        tlevel = intermediate
        and Tarea = language arts
        and language skills # writing
        and achlevel = high
        and DIR ge 0.8
        then DIRval = high <0.7>.
        message "You are conducting a great deal of direct instruction in",
                "your classroom.  This is a sound instructional practice.",
                "The high amount of direct instruction is particularly",
                "important when basic skills are being taught.",
                " ".
        display attach reference5 of kb.
        display attach reference9 of kb.
        endif.

DIR1cc:
        if
        tlevel = intermediate
        and Tarea = language arts
        and language skills = writing
        and achlevel = high
        and DIR ge 0.8
        then DIRval = low <0.7>.
        message "You are providing too much direct instruction when you teach",
                "writing.  Students require a lot more time in class for the",
                "practice of writing.",
                " ".
        display attach reference10 of kb.
        endif.

\******medium dir starts here

DIR1L12a:
        if
        tlevel = primary
        and Tarea = reading
        and reading skills # comprehension
        and achlevel = high
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "Increasing direct instruction somewhat should help to in-",
                "crease your students' basic reading skills.",
                " ".
        display attach reference14 of kb.
        endif.

DIR1L12b:
        if
        tlevel = primary
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and achlevel = high
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "Increasing direct instruction somewhat should help to in-",
                "crease your students' basic reading skills.",
                " ".
        display attach reference14 of kb.
        endif.

DIR1m13:
        if
        tlevel = primary
        and Tarea = language arts
        and language skills # writing
        and achlevel = high
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "Increasing direct instruction somewhat should help to in-",
                "crease your students' basic skills in language arts.",
                " ".
        display attach reference14 of kb.
        endif.

DIR1n14a:
        if
        tlevel = intermediate
        and Tarea = reading
        and reading skills # comprehension
        and achlevel = high
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high  <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "For high achievement students working on basic reading",
                "skills, this amount is a sound instructional practice.",
                " ".
        display attach reference5 of kb.
        endif.

DIR1n14b:
        if
        tlevel = intermediate
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and achlevel = high
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high  <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "For high achievement students working on basic reading",
                "skills, this amount is a sound instructional practice.",
                " ".
        display attach reference5 of kb.
        endif.


DIR1o15:
        if
        tlevel = intermediate
        and Tarea = language arts
        and language skills # writing
        and achlevel = high
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high  <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "For high achievement students working on language basic",
                "skills, this amount is a sound instructional practice.".
        display attach reference3 of kb.
        endif.

DIR1p16a:
        if
        tlevel = primary
        and Tarea = reading
        and reading skills # comprehension
        and achlevel = low ¦ average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "For low and average achievement primary students working on",
                "basic skills, increasing their direct instruction somewhat",
                "may produce higher achievement.",
                " ".
        display attach reference14 of kb.
        endif.

DIR1p16b:
        if
        tlevel = primary
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and achlevel = low ¦ average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "For low and average achievement primary students working on",
                "basic skills, increasing their direct instruction somewhat",
                "may produce higher achievement.",
                " ".
        display attach reference14 of kb.
        endif.

DIR1q17:
        if
        tlevel = primary
        and Tarea = language arts
        and language skills # writing
        and achlevel = low ¦ average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "For low and average achievement primary students working on",
                "basic skills, increasing their direct instruction somewhat",
                "may produce higher achievement.",
                " ".
        display attach reference14 of kb.
        endif.


DIR1r18:
        if
        tlevel = intermediate
        and Tarea = language arts
        and language skills # writing
        or Tgoal = tests
        and achlevel = low
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "To improve language basic skills, your low achievement",
                "students should have somewhat more direct instruction.",
                " ".
        display attach reference3 of kb.
        endif.

DIR1s19a:
        if
        tlevel = intermediate
        and Tarea = reading
        and reading skills # comprehension
        and achlevel = low
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "To improve basic reading skills, your low achievement",
                "students should have somewhat more direct instruction.".
        display attach reference3 of kb.
        endif.

DIR1s19b:
        if
        tlevel = intermediate
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and achlevel = low
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "To improve basic reading skills, your low achievement",
                "students should have somewhat more direct instruction.".
        display attach reference3 of kb.
        endif.

DIR1t20:
        if
        tlevel = intermediate
        and Tarea = language arts
        and language skills # writing
        and achlevel = average
        and SES = poor
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "To improve basic skills in language arts, your students",
                "should have somewhat more direct instruction.",
                " ".
        display attach reference3 of kb.
        endif.

DIR1u21a:
        if
        tlevel = intermediate
        and Tarea = reading
        and reading skills # comprehension
        and achlevel = average
        and SES = middle class ¦  upper class
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "This amount is a sound instructional practice for your",
                "students.",
                " ".
        display attach reference15 of kb.
        endif.

DIR1u21b:
        if
        tlevel = intermediate
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and achlevel = average
        and SES = middle class ¦  upper class
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "This amount is a sound instructional practice for your",
                "students.",
                " ".
        display attach reference15 of kb.
        endif.

DIR1v22a:
        if
        tlevel = intermediate
        and Tarea = reading
        and reading skills # comprehension
        and achlevel = average
        and SES = poor
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "To improve basic reading skills, your students should have",
                "somewhat more direct instruction.",
                " ".
        display attach reference3 of kb.
        endif.

DIR1v22b:
        if
        tlevel = intermediate
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and achlevel = average
        and SES = poor
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "To improve basic reading skills, your students should have",
                "somewhat more direct instruction.",
                " ".
        display attach reference3 of kb.
        endif.

DIR1w23:
        if
        tlevel = intermediate
        and Tarea = language arts
        and language skills # writing
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "This amount is a sound instructional practice for your",
                "students.",
                " ".
        display attach reference15 of kb.
        endif.

DIR1x24a:
        if tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills = comprehension
        and achlevel = high
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "Reducing direct instruction somewhat should improve your",
                "students' comprehension and/or writing performance.  Your",
                "students require adequate time for independent seatwork.",
                " ".
        display attach reference10 of kb.
        endif.


DIR1x24b:
        if tlevel = primary ¦ intermediate
        and Tarea =  language arts
        and language skills = writing
        and achlevel = high
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "Reducing direct instruction somewhat should improve your",
                "students' comprehension and/or writing performance.  Your",
                "students require adequate time for independent seatwork.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1y25a:
        if tlevel = primary
        and Tarea = reading
        and reading skills = comprehension
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.7>.
        message "You are providing a moderate amount of direct instruction.",
                "Reducing direct instruction somewhat should improve your",
                "students' comprehension and/or writing performance.  Your",
                "students require adequate time for independent seatwork.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1y25b:
        if tlevel = primary
        and Tarea = language arts
        and language skills = writing
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.7>.
        message "You are providing a moderate amount of direct instruction.",
                "Reducing direct instruction somewhat should improve your",
                "students' comprehension and/or writing performance.  Your",
                "students require adequate time for independent seatwork.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1z26a:
        if
        tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills = comprehension
        and SES = poor
        and achlevel = low ¦ average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high <0.7>.
        message "You are providing a moderate amount of direct instruction.",
                "With your students this amount is a sound instructional",
                "practice.",
                " ".
        display attach reference5 of kb.
        endif.


DIR1z26b:
        if
        tlevel = primary ¦ intermediate
        and Tarea =  language arts
        and language skills = writing
        and SES = poor
        and achlevel = low ¦ average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high <0.7>.
        message "You are providing a moderate amount of direct instruction.",
                "With your students this amount is a sound instructional",
                "practice.",
                " ".
        display attach reference5 of kb.
        endif.


DIR1aa27:
        if
        tlevel = intermediate
        and Tarea = reading
        and reading skills = comprehension
        and SES = middle class ¦ upper class
        and achlevel = average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.6>.
        message "You are providing a moderate amount of direct instruction.",
                "Reducing direct instruction somewhat should improve your",
                "students' reading comprehension.  They need adequate time",
                "for silent reading.",
                " ".
        display attach reference10 of kb.
        endif.
```

```
DIR1bb28:
        if
        tlevel = intermediate
        and Tarea = reading
        and reading skills = comprehension
        and SES = poor
        and achlevel = average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high <0.6>.
        message "You are providing a moderate amount of direct instruction.",
                "With your students this amount is a sound instructional",
                "practice.",
                " ".
        display attach reference5 of kb.
        endif.

DIR1cc29:
        if
        tlevel = intermediate
        and Tarea = language arts
        and language skills = writing
        and SES = middle class ¦ upper class
        and achlevel = average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = low <0.6>.
        message "You are providing a moderate amount of direct instruction.",
                "Your students should benefit from a reduction of direct",
                "instruction.  They need adequate time for practicing writing.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1dd30:
        if
        tlevel = intermediate
        and Tarea = language arts
        and language skills = writing
        and SES = poor
        and achlevel = average
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = medium <0.6>.
        message "You are providing a moderate amount of direct instruction.",
                "Reducing direct instruction somewhat should improve your",
                "students' writing performance.  They need adequate time for",
                "practicing writing.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1ee31a:
        if
        tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills = comprehension
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high <0.7>.
        message "You are providing a moderate amount of direct instruction.",
                "With your students this amount is a sound instructional",
                "practice.",
                " ".
        display attach reference5 of kb.
        endif.


DIR1ee31b:
        if
        tlevel = primary ¦ intermediate
        and Tarea = language arts
        and language skills = writing
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR lt 0.8
        and DIR ge 0.7
        then DIRval = high <0.7>.
        message "You are providing a moderate amount of direct instruction.",
                "With your students this amount is a sound instructional",
                "practice.",
                " ".
        display attach reference5 of kb.
        endif.



\****************low DIR for language arts and reading starts here

DIR1ff32aa:
        if
        tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills # comprehension
        and achlevel = low
        and DIR lt 0.7
        and DIR ge 0.5
        then DIRval = low  <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  However, in basic skills instruction your students",
                "should receive a high amount of direct instruction.",
                " ".
        display attach reference9 of kb.
        display attach reference14 of kb.
        endif.


DIR1ff32ab:
        if
        tlevel = primary ¦ intermediate
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and achlevel = low
        and DIR lt 0.7
        and DIR ge 0.5
        then DIRval = low  <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  However, in basic skills instruction your students",
                "should receive a high amount of direct instruction.",
                " ".
        display attach reference9 of kb.
        display attach reference14 of kb.
        endif.


DIR1ff32ba:
        if
        tlevel = primary ¦ intermediate
        and Tarea = language arts
        and language skills # writing
```

```
    and achlevel = low
    and DIR lt 0.7
    and DIR ge 0.5
    then DIRval = low  <0.3>.
    message "You are providing a relatively low amount of direct instruc-",
        "tion.  However, in basic skills instruction your students",
        "should receive a high amount of direct instruction.",
        " ".
    display attach reference9 of kb.
    display attach reference14 of kb.
    endif.


DIR1ff32bb:
    if
    tlevel = primary ¦ intermediate
    and Tarea # reading ¦ mathematics ¦ language arts
    and Tgoal = tests
    and achlevel = low
    and DIR lt 0.7
    and DIR ge 0.5
    then DIRval = low  <0.8>.
    message "You are providing a relatively low amount of direct instruc-",
        "tion.  However, in basic skills instruction your students",
        "should receive a high amount of direct instruction.",
        " ".
    display attach reference9 of kb.
    display attach reference14 of kb.
    endif.



DIR1gg33aa:
    if
    tlevel = primary ¦ intermediate
    and Tarea = reading
    and reading skills # comprehension
    and SES = middle class ¦ upper class
    and achlevel = average ¦ high
    and DIR lt 0.7
    and DIR ge 0.5
    then DIRval = medium <0.7>.
    message "You are providing a relatively low amount of direct instruc-",
        "tion.  However, when basic skills are being taught, your",
        "students will benefit from a higher amount of direct",
        "instruction.",
        " ".
    display attach reference9 of kb.
    display attach reference14 of kb.
    endif.


DIR1gg33ab:
    if
    tlevel = primary ¦ intermediate
    and Tarea # reading ¦ mathematics ¦ language arts
    and Tgoal = tests
    and SES = middle class ¦ upper class
    and achlevel = average ¦ high
    and DIR lt 0.7
    and DIR ge 0.5
    then DIRval = medium <0.7>.
    message "You are providing a relatively low amount of direct instruc-",
        "tion.  However, when basic skills are being taught, your",
        "students will benefit from a higher amount of direct",
        "instruction.",
        " "
```

```
                " ".
        display attach reference9 of kb.
        display attach reference14 of kb.
        endif.


DIR1gg33ba:
        if
        tlevel = primary ¦ intermediate
        and Tarea = language arts
        and language skills # writing
        and SES = middle class ¦ upper class
        and achlevel = average ¦ high
        and DIR lt 0.7
        and DIR ge 0.5
        then DIRval = medium <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  However, when basic skills are being taught, your",
                "students will benefit from a higher amount of direct",
                "instruction.",
                " ".
        display attach reference9 of kb.
        display attach reference14 of kb.
        endif.

DIR1gg33bb:
        if
        tlevel = primary ¦ intermediate
        and Tarea # reading ¦ mathematics ¦ language arts
        and Tgoal = tests
        and SES = middle class ¦ upper class
        and achlevel = average ¦ high
        and DIR lt 0.7
        and DIR ge 0.5
        then DIRval = medium <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  However, when basic skills are being taught, your",
                "students will benefit from a higher amount of direct",
                "instruction.",
                " ".
        display attach reference9 of kb.
        display attach reference14 of kb.
        endif.



DIR1hh34aa:
        if
        tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills # comprehension
        and SES = poor
        and achlevel = average ¦ high
        and DIR lt 0.7
        and DIR ge 0.5
        then DIRval =  medium <0.6>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students may have higher performance in basic",
                "skills if you increase direct instruction.",
                " ".
        display attach reference9 of kb.
        display attach reference14 of kb.
        endif.

DIR1hh34ab:
        if
        tlevel = primary ¦ intermediate
        and Tgoal = tests
        and Tarea # reading ¦ mathematics ¦ language arts
        and SES = poor
        and achlevel = average ¦ high
        and DIR lt 0.7
        and DIR ge 0.5
        then DIRval =  medium <0.6>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students may have higher performance in basic",
                "skills if you increase direct instruction.",
                " ".
        display attach reference9 of kb.
        display attach reference14 of kb.
        endif.

DIR1hh34ba:
        if
        tlevel = primary ¦ intermediate
        and Tarea = language arts
        and language skills # writing
        and SES = poor
        and achlevel = average ¦ high
        and DIR lt 0.7
        and DIR ge 0.5
        then DIRval =  medium <0.6>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students may have higher performance in basic",
                "skills if you increase direct instruction.",
                " ".
        display attach reference9 of kb.
        display attach reference14 of kb.
        endif.
DIR1hh34bb:
        if
        tlevel = primary ¦ intermediate
        and Tgoal = tests
        and Tarea # reading ¦ mathematics ¦ language arts
        and SES = poor
        and achlevel = average ¦ high
        and DIR lt 0.7
        and DIR ge 0.5
        then DIRval =  medium <0.6>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students may have higher performance in basic",
                "skills if you increase direct instruction.",
                " ".
        display attach reference9 of kb.
        display attach reference14 of kb.
        endif.

DIR1ii35:

        if
        tlevel = primary
        and Tarea = reading
        and reading skills = comprehension
        and achlevel = low
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = low <0.5>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Low achievement students require more direct instruc-",
                "tion.  Teaching them specific comprehension strategies will",
                "help them improve reading comprehension.",
                " ".
        display attach reference3 of kb.
        display attach reference14 of kb.
        endif.

DIR1jj36:
        if
        tlevel = intermediate
        and Tarea = reading
        and reading skills = comprehension
        and SES = poor
        and achlevel = low ¦ average
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = medium <0.5>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students may require somewhat more direct",
                "instruction.  Teaching them specific comprehension",
                "strategies while also providing time for silent reading",
                "will help them improve reading comprehension.",
                " ".
        display attach reference3 of kb.
        display attach reference14 of kb.
        endif.

DIR1kk37:
        if
        tlevel = primary ¦ intermediate
        and Tarea = language arts
        and language skills = writing
        and achlevel = low
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval =  medium <0.9>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Though your students require adequate class time for",
                "the practice of writing, they also need direct instruction",
                "in writing skills.",
                " ".
        display attach reference14 of kb.
        endif.

DIR1LL38aa:
        if
        tlevel = primary ¦ intermediate
        and Tarea = reading
        and reading skills = comprehension
        and SES = middle class ¦ upper class
        and achlevel = average ¦ high
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = high <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion, which is a sound instructional practice for your stu-",
                "dents.  They need adequate class time for the reading and/or",
                "writing.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1LL38ab:
        if
        tlevel = primary ¦ intermediate
        and Tgoal = tests
        and Tarea # reading ¦ mathematics ¦ language arts
        and SES = middle class ¦ upper class
        and achlevel = average ¦ high
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = high <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion, which is a sound instructional practice for your stu-",
                "dents.  They need adequate class time for the reading and/or",
                "writing.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1LL38ba:
        if
        tlevel = primary ¦ intermediate
        and Tarea = language arts
        and language skills # writing
        and SES = middle class ¦ upper class
        and achlevel = average ¦ high
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = high <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion, which is a sound instructional practice for your stu-",
                "dents.  They need adequate class time for the reading and/or",
                "writing.",
                " ".
        display attach reference10 of kb.
        endif.

DIR1LL38bb:
        if
        tlevel = primary ¦ intermediate
        and Tgoal = tests
        and Tarea # reading ¦ mathematics ¦ language arts
        and SES = middle class ¦ upper class
        and achlevel = average ¦ high
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = high <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion, which is a sound instructional practice for your stu-",
                "dents.  They need adequate class time for the reading and/or",
                "writing.",
                " ".
        display attach reference10 of kb.
        endif.


DIR1mm39:
        if
        tlevel = intermediate
        and Tarea = reading
        and reading skills = comprehension
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = medium <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Though your students require adequate class time for",
                "silent reading, they also need direct instruction in compre-",
                "hension skills.",
                " ".
        display attach reference14 of kb.
        endif.
```

```
DIR1nn40a:
        if tlevel = intermediate ¦ primary
        and Tarea = reading
        and reading skills = comprehension
        and SES = poor
        and achlevel = high
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = high <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion, which is a sound instructional practice for your stu-",
                "dents.  They need adequate class time for the reading and/or",
                "writing.",
                " ".
        display attach reference10 of kb.
        endif.


DIR1nn40b:
        if tlevel = intermediate ¦ primary
        and Tarea = language arts
        and language skills = writing
        and SES = poor
        and achlevel = high
        and DIR ge 0.5
        and DIR lt 0.7
        then DIRval = high <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion, which is a sound instructional practice for your stu-",
                "dents.  They need adequate class time for the reading and/or",
                "writing.",
                " ".
        display attach reference10 of kb.
        endif.


speddir:
        if Tarea = special education
        then
        message "This system was developed for regular education",
        "teachers whose classrooms include mainstreamed special education",
        "students.  You probably will not find the questions or the",
        "recommendations appropriate for you.  If you would like to",
        "continue using the SNAP system, you will have to begin again",
        "and use one of the other subject areas when you are asked for",
        "this information.".
        endif.

DIRa:
        if DIRval = high
        then DIRprob = none.
        endif.

DIRb:
        if DIRval = medium
        and achlevel = average ¦ high
        then DIRprob = none.
        endif.

DIRc:
        if DIRval = medium
        and achlevel = low
        and tlevel = primary ¦ intermediate
        and DIR ge 0.8
        then DIRprob = high.
        endif.
```

```
DIRe:
        if DIRval = medium
        and achlevel = low
        and tlevel = primary ¦ intermediate
        and DIR lt 0.7
        then DIRprob = low.
        endif.


DIRg:
        if DIRval = low
        and DIR ge 0.7
        then DIRprob = high.
        endif.

DIRh:
        if DIRval = low
        and tlevel = primary ¦ intermediate
        and DIR lt 0.7
        then DIRprob = low.
        endif.

%

actions:

message " ",
" ",
" ",
" ",
" ",
" ",
" ",
" ",
"                                Welcome ",
"                                to the ",
"                      Teacher Effectiveness Planner ",
" ",
" ",
" ",
" ",
" ".
break.
message " ",
        " ",
        " ",
"       This system will help to determine what types of training options",
"the system should recommend for you based upon the research literature on ",
"teacher effectiveness.  Three areas of teaching practice have been ",
"included in the present system:  academic learning time, direct instruction,",
"and questioning.  The system will ask you questions about your students,",
"your classroom, your school,  your common teaching practices, and your",
"interpretation of your students'learning needs.  In addition, you will be",
"asked to enter data from the self observations you have already completed.",
" ",
"       For some of the questions, the answers are very specific, such as ",
" 'What grade do you teach?' For other questions, the answers will require",
"some serious thought on your part.  For example, one of the questions you",
"may be asked is 'What is your most important teaching goal?'.  While we ",
"understand that teachers almost always have more than one goal in mind for",
"any single teaching activity, the system is not yet sophisticated enough ",
"to consider all the complexity that goes into teaching.  We ask that you",
"try to determine, to the best of your ability, the best answer to the",
"question that most accurately describes you as a teacher.".
```

```
break.

message " ",
" ",
" ",
" ",
"     You have already been given some brief instructions about using the",
"SNAP system on the computer, but in case you need a few reminders, here are",
"a few things you should remember:  ",
" ",
"         1.   Whenever you see 'ready for command', you can do one of",
"              the following:  type 'continue', type 'explain' ",
"              if you would like an explanation of the question or one of the ",
"              answer choices, or type 'freeze <your name>' to stop the SNAP ",
"              system and allow you to return to it at a  later time.",
" ",
"         2.   If you are asked a questions that allows you to choose more ",
"              than one answer,  connect your choices with  the '&' symbol.",
" ",
"         3.   If you do not know an answer and cannot figure out an answer",
"              that makes sense, you may enter 'unknown' for any question,",
"              but this will result in poor response by the computer system.",
"              You will be better off simply choosing one of the possible ",
"              answer choices given to you.",
" ",
" ".
break.

message " ".

message " The SNAP system will now use the part of its knowledge base",
        "on teacher effectiveness that deals with the amount of direct",
        "instruction provided in a classroom.  The information used to ",
        "determine whether you are providing the amount of direct instruction",
        "that research would indicate is good for your situation will come",
        "from data that you enter from Observation 1 (giving amounts of time",
        "that the students were in your classroom and amounts of time that",
        "you were teaching them), from additional questions that the ",
        "computer will ask you, and from drawing inferences from this data.",
" ",
" ",
" ",
" ",
" ".
break.
message "First the system will determine the amount of time that is allocated",
        "for instruction on an average school day.".
obtain alloctm.
message "The amount of allocated time (in minutes) on an average day is: ".
display value of alloctm.
break.

message "Now the system will determine the amount of time that is spent in",
        "providing direct instruction to students in your classroom.".
obtain teachtm.
message "The amount of teaching time (in minutes) on an average day is:".
display value of teachtm.
break.

message "Now the system will determine how well your direct instruction ratio",
        "(DIR) matches what would be suggested as ideal by researchers.".
obtain DIR.
message "Your Direct Instruction Ratio (DIR) is:      ".
display value of DIR.
message "This is the ratio of teaching time to allocated time.".
break.
```

```
obtain DIRval .

message "The amount of direct instruction you provide in your classroom is" .
display value of DIRval .
break.

message "If you would like to see the rule that the system used to evaluate ",
        "your Direct Instruction Ratio, type JUSTIFY DIRval".
break.

obtain DIRprob.
message  "Your training needs related to direct instruction are as follows:".
display value of DIRprob.
message "You can interpret these as follows:                              ",
        " 'none' means that you have no particular training needs         ",
        "                related to direct instruction;                   ",
        " 'high' means that you are using too much direct instruction;    ",
        "''low' means that you are not providing enough direct instruction".
write "a:dir.dta", DIR, DIRval, DIRprob.
break.


message "You are now finished with this section of the SNAP system.  To",
"go on to the next section, you will have to exit from this part of the ",
" SNAP system by typing 'stop'.  Then, when you have the C prompt,      ",
"type 'kesr altkb.pkb'".

break.
%
```

```
C>type secdir
\snapkb

text:
        {certification: "This knowledge base determines training",
        "needs related to the teacher effectiveness literature",
        "on academic learning time, questioning skill, and direct",
        "instruction.  It was written in 1985 by Jackie Haynes and",
        "revised and enlarged by Jackie Haynes and Jennie Pilato",
        "in January, 1986."}

        {certainties:  "Certainty factors were determined by following",
        "the following rules:  If a substantial piece of research was",
        "used to write a rule and all elements embodied in the resarch",
        "are contained in the rule, the certainty factor assigned is 1.0.",
        "If the rule was derived from another rule with a certainty factor",
        "of 1.0 by changing one attribute, the certainty factor is reduced",
        "by 0.1.  For each additional change to the original rule, another",
        "0.1 is subtracted from the certainty factor for that rule.  It is",
        "therefore possible to determine how far removed a rule is from the",
        "original research upon which it was based by examining its",
        "certainty factor."}

        {reference1:  "Anderson & Scott, 1978"}
        {reference2:  "Brophy, 1983"}
        {reference3:  "Brophy & Good, 1986"}
        {reference4:  "Centra & Potter, 1980"}
        {reference5:  "Emans, 1983"}
        {reference6:  "Evertson, 1980"}
        {reference7:  "Fisher, Berliner, Filby, Marliave, Cahen, & Dishaw",
                      "1978"}
        {reference8:  "Good & Grouws, 1979"}
        {reference9:  "Medley & Crook, 1980"}
        {reference10: "Peterson, 1979"}
        {reference11: "Rieth, Polsgrove, & Semmel, 1981"}
        {reference12: "Rosenshine, 1980"}
        {reference13: "Rosenshine, 1983"}
        {reference14: "Rosenshine, 1986"}
        {reference15: "Souster, 1982"}
        {reference16: "Stallings, 1976"}
        {reference17: "Stallings & Kaskowitz, 1974"}
%

attributes:

 alloctm: real
        [constraint:  alloctm ge 0.0 and alloctm le 600.0]
        {explain:  "Allocated time is the total amount of time that COULD",
        "be used for instruction.  It excludes time used for recess, lunch,",
        "school plays, transition from one class to another, etc. "}
        {definition: "The amount of time students are in their classroom in a",
                "given school day"}.


teachtm:  real
        [constraint:  teachtm ge 0.0 and teachtm le 600.0]
        {definition:  "Teaching time is the amount of time a teacher",
                " spends providing direct instruction to the entire",
                "class or a subgroup of the class in a given school day."}.

DIR:  real
        [constraint:  DIR  ge 0 and DIR  le 1.0]
        {definition:  "the proportion of time available for direct",
         " instruction  that is actually used for that purpose"}.

DIRval: mlt
        (high, medium, low)
        {definition: "the evaluation of the teacher's reported data on",
                "the amount of direct instruction provided in the classroom,",
                "considering other variables that affect what this value",
                 "should be"}.

SES:  sgl
        (poor, middle class, upper class)
        {question:  "What is the socio-economic status of your students?"}
        {definition: "the general socio-economic status of the majority of",
                   " the students in a given classroom"}.

Tarea: mlt
        (mathematics,
         English
   {question:"English (including study skills and reading)"},
         reading {question:"reading (at the elementary level)"},
         language arts,
         science,
         social studies,
         art,
         music,
         physical education,
         home economics,
         foreign language,
         health education,
         industrial arts,
         special education {explain:  "Special Education, any grade level"},
         other)
        {question:  "What subject do you teach?"}
        {definition:  "specific skill and/or content areas you teach, or," ,
                       "if you are a generalist, any areas that you ",
                       "specialize in"}.

science focus: sgl
        (labs, lecture
                {question:  "lecture and demonstration"},
         discussion)
        {question:  "What form of instruction in science is most like ",
                "what you were doing during the self observations?"}.

Tlevel: sgl
        (primary
                {question: "Kindergarten thru Grade 3"},
       intermediate
                {question: "Grades 4 thru 6"},
        junior high
                {question: "Any grade in a school including grades 6 thru 9"},
        high school
                {question: "Any  grade in a school including 9 thru 12"})
        {question:  "What level do you teach?"}
        {definition:  "The level at which you are assigned (not the",
            "instructional level of your students) to teach most of",
            "the time."}.

Tgoal: sgl
        (tests {question: "improving achievement as reflected in",
        " standardized test scores"},
         self concept {question:  "enhancing students' self concept"},
         school attitude {question:  "improving students attitudes",
                " toward school"},
        creativity {question:  "improving students creative thinking",
                " and problem solving"})
        {question:  "What is your most important teaching goal?"}.

achlevel:  mlt
        (high, average, low)
        {question: "What is the achievement level of most of your students?"}
        {definition:  "The achievement level of your students relative to",
        "             national norms on achievement tests."}.


reading skills: mlt
        (beginnning rdg
        {question:  "beginning reading skills (decoding, phonics,",
                    " letter recognition)"},
        basic skills
        {question:  " basic skills in reading (phonics, syllabication, ",
                    "prefixes & suffixes, root words, etc.)"},
        vocabulary
        {question:  "learning to recognize, use, and/or spell new words "},
        comprehension
        {question:  "developing the ability to understand text at literal,",
                    "inferential, and problem solving levels"})
        {question:  "What reading skills were you teaching during the",
                    "time you were conducting the self observation ?"}.

language skills:  mlt
        (oral expression
        {question:  "oral expression (giving oral reports, speeches, etc.)"},
         grammar
        {question:  "grammar (subject-verb agreement, parts of speech,",
                    "types of sentences, correct usage, etc.)"},
         language mechanics
        {question:  "mechanics of written language (capitalization,",
                    " punctuation, etc."},
          writing
        {question:  "writing, including creative and expository writing"})
        {question:  "What language arts skills were you teaching during the",
                    "time you were conducting the self observation?"}.

DIRprob:  sgl
        (none, high, low)
        {explain:  "DIRprob means there is a problem with DIR,and the",
                   "value high or low indicates the direction of the",
                   "problem."}.

%

externals:
        allocatedtime:
                [program: "timal"]
                [outputs: alloctm]
                [outputfile: "timal.dta"].
        teachingtime:
                [program: "timtc"]
                [outputs: teachtm]
                [outputfile: "timtc.dta"].
%

rules:

DIRother4:

        if
        Tlevel = junior high ¦ high school
        and Tgoal # tests
        and Tarea = mathematics ¦ English ¦ science ¦ social studies
        and Tarea = mathematics ¦ English ¦ science ¦ social studies
                    ¦ foreign language
        and DIR lt 0.5
        and DIR ge 0.33
        then
        DIRval = high  <0.6> .
        message "If you are trying to improve your students' creativity",
        "problem solving skills, attitude toward school, or self concept,",
        "you are giving them some direct instruction, which is essential,",
        "but you are also doing lots of other types of activities which are",
        "better than direct instruction for promoting your major goals.".
        endif.


DIRother5:

        if
        Tlevel = junior high ¦ high school
        and Tgoal # tests
        and Tarea = mathematics ¦ English ¦ science ¦ social studies
                    ¦ foreign language
        and DIR ge 0.5
        and DIR lt 0.7
        then
        DIRval = medium  <0.6> .
        message "If you are trying to improve your students' creativity",
        "problem solving skills, attitude toward school, or self concept,",
        "it would be better to use less direct instruction and allow more",
        "time for other types of activities.".
        endif.


DIRother6:

        if
        Tlevel = junior high ¦ high school
        and Tgoal # tests
        and Tarea = mathematics ¦ English ¦ science ¦ social studies
                    ¦ foreign language
        and DIR ge 0.7
        then
        DIRval = low  <0.6> .
        message "If you are trying to improve your students' creativity",
        "problem solving skills, attitude toward school, or self concept,",
        "it would be better to use less direct instruction and allow more",
        "time for other types of activities.".
        endif.

DIRother7:
        if
        Tlevel = junior high ¦ high school
        and DIR lt 0.33
        then DIRval = low <0.9>.
        message "You are providing very little direct instruction to your",
        "students.  Any time direct instruction decreases below 33% of the",
        "class time, students obtain very little gain from their schooling.",
        "More direct instruction is strongly urged.".
        endif.

secDIR1a:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and SES = poor
        and achlevel = low
        and DIR ge 0.75
        then DIRval = high <0.9>
        then DIRval = high <0.5>.
        message "You are providing a high amount of direct instruction,",
                "which is a sound instructional practice with your students.",
                "Closely monitored seatwork is needed with frequent oppor-",
                "tunities for students to respond to questions.",
                " ".
        display attach reference3 of kb.
        display attach reference6 of kb.
        endif.

secDIR1b:

        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR ge 0.75
        then DIRval = high <0.6>.
        message "You are providing a high amount of direct instruction,",
                "which is a sound instructional practice with your students.",
                "Closely monitored seatwork is needed with frequent oppor-",
                "tunities for students to respond to questions.",
                " ".
        display attach reference3 of kb.
        display attach reference6 of kb.
        endif.

secDIR1c:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and SES = poor
        and achlevel = average
        and DIR ge 0.75
        then DIRval = high <0.6>.
        message "You are providing a high amount of direct instruction,",
                "which is a sound instructional practice with your students.",
                "Closely monitored seatwork is needed with frequent oppor-",
                "tunities for students to respond to questions.",
                " ".
        display attach reference3 of kb.
        display attach reference6 of kb.
        endif.

secDIR1d:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and achlevel = high
        and DIR ge 0.75
        then DIRval = high <0.7>.
        message "You are providing a high amount of direct instruction.",
                "This is a sound instructional practice with your students",
                "who need a relatively fast pace through course content.",
                " ".
        display attach reference3 of kb.
        endif.

secDIR1e:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and SES =  middle class ¦ upper class
        and achlevel = average
        and DIR ge 0.75
        then DIRval = high <0.7>
        then DIRval = high <0.7>.
        message "You are providing a high amount of direct instruction,",
                "which is a sound instructional practice with your students.",
                "Closely monitored seatwork is needed with frequent oppor-",
                "tunities for students to respond to questions.",
                " ".
        display attach reference3 of kb.
        display attach reference6 of kb.
        endif.
\*****

secDIR1a1:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        or Tgoal = tests
        and SES = poor
        and achlevel = low
        and DIR lt 0.75
        and DIR ge 0.5
        then DIRval = medium <0.7>.
        DIRprob = high.
        message "You are providing a moderate amount of direct instruction.",
                "Your students should benefit from somewhat more direct",
                "instruction.  Closely monitored seatwork is needed with",
                "frequent opportunities for students to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

secDIR1b2:

        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR lt 0.75
        and DIR ge 0.5
        then DIRval = medium <0.5>.
        DIRprob = high.
        message "You are providing a moderate amount of direct instruction.",
                "Your students should benefit from somewhat more direct",
                "instruction.  Closely monitored seatwork is needed with",
                "frequent opportunities for students to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

secDIR1c3:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and SES = poor
        and achlevel = average
        and DIR lt 0.75
        and DIR ge 0.5
        then DIRval = medium <0.5>.
        message "You are providing a moderate amount of direct instruction.",
                "Your students should benefit from somewhat more direct",
                "instruction.  Closely monitored seatwork is needed with",
                "frequent opportunities for students to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

secDIR1d4:
```

```
secDIR1d4:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and achlevel = high
        and DIR lt 0.75
        and DIR ge 0.5
        then DIRval = medium <0.7>.
        message "You are providing a moderate amount of direct instruction.",
                "Your high achievement students will benefit from somewhat",
                "more direct instruction with a relatively fast pace through",
                "course content.",
                " ".
        display attach reference3 of kb.
        display attach reference14 of kb.
        endif.

secDIR1e5:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and SES = middle class ¦ upper class
        and achlevel = average
        and DIR lt 0.75
        and DIR ge 0.5
        then DIRval = medium <0.6>.
        message "You are providing a moderate amount of direct instruction.",
                "Your students should benefit from somewhat more direct",
                "instruction.  Closely monitored seatwork is needed with",
                "frequent opportunities for students to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

secDIR1f6:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and SES = poor
        and achlevel = low
        and DIR lt 0.5
        and DIR ge 0.33
        then DIRval = low <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should benefit from a high amount of",
                "direct instruction.  They need closely monitored seatwork",
                "and frequent opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        display attach reference14 of kb.
        endif.

secDIR1g7:

        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and SES = middle class ¦ upper class
        and achlevel = low
        and DIR lt 0.5
        and DIR ge 0.33
        then DIRval = low <0.5>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should benefit from a high amount of",
                "direct instruction.  They need closely monitored seatwork",
                "and frequent opportunities to respond to questions.",
                " "
        display attach reference3 of kb.
        display attach reference14 of kb.
        endif.

secDIR1h8:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and SES = poor
        and achlevel = average
        and DIR lt 0.5
        and DIR ge 0.33
        then DIRval = low <0.5>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should benefit from a high amount of",
                "direct instruction.  They need closely monitored seatwork",
                "and frequent opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        display attach reference14 of kb.
        endif.

secDIR1i9:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and achlevel = high
        and DIR lt 0.5
        and DIR ge 0.33
        then DIRval = low <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students will benefit from a high amount of",
                "direct instruction with a relatively fast pace through",
                "course content.",
                " ".
        display attach reference3 of kb.
        display attach reference14 of kb.
        endif.

secDIR1j10:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR lt 0.5
        and DIR ge 0.33
        then DIRval = low <0.6>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should benefit from a high amount of",
                "direct instruction.  They need closely monitored seatwork",
                "and frequent opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        display attach reference14 of kb.
        endif.

secDIR1k11:
        if
        Tlevel = junior high ¦ high school
        and Tarea = mathematics ¦ foreign language ¦ music
        and DIR lt 0.33
        then DIRval= low.
        message "You are providing a very low amount of direct instruction.",
                "Research indicates the importance of a high amount of direct",
                "instruction.  To improve student achievement you should in-",
                "crease direct instruction considerably.",
                " ".
        display attach reference5 of kb.
        display attach reference14 of kb.
        endif.


secDIR1f:
        if Tlevel = junior high
        and Tarea = English
        and achlevel = average
        and SES = middle class ¦ upper class
        and DIR ge 0.75
        then DIRval = medium <0.7>.
        message "You are providing a high amount of direct instruction.  Your",
                "students should benefit from somewhat less direct instruc-",
                "tion.  They need some class time for independent reading,",
                "writing, and other activities assigned as homework.",
                " ".
        display attach reference1 of kb.
        display attach reference3 of kb.
        endif.

secDIR1o:
        if
        Tlevel = junior high ¦ high school
        and Tarea = English
        and SES = poor
        and achlevel = low
        and DIR ge 0.75
        then DIRval = high <0.8>.
        message "You are providing a high amount of direct instruction, which",
                "is a sound instructional practice for your students.  They",
                "should benefit from guided practice and high amount of",
                "opportunities to respond to questions.",
                " ".
        display attach reference5 of kb.
        endif.


\end of achlevel = low
secDIR1z:
        if
        Tlevel = junior high
        and Tarea = English
        and achlevel = high
        and DIR ge 0.75
        then DIRval = high <0.8>.
        message "You are providing a high amount of direct instruction, which",
                "is a sound instructional practice for your high achievement",
                "students.  They benefit from a brisk pace and generally do",
                "not require much class time for independent work.",
                " ".
        display attach reference3 of kb.
        endif.

\******medium dir starts here

secDIR1L12:
        if
        Tlevel = junior high
        and Tarea = English
        and achlevel = high
        and DIR lt 0.75
        and DIR ge 0.5
        then DIRval = medium <0.[illegible]>
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "Your high achievement students should benefit from somewhat",
                "more direct instruction so that they usually experience a",
                "brisk pace with relatively little time for independent",
                "work.",
                " ".
        display attach reference3 of kb.
        endif.


secDIR1p16:
        if
        Tlevel = junior high
        and Tarea = English
        and achlevel = low ¦ average
        and DIR lt 0.75
        and DIR ge 0.5
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "Your low achievement students should benefit from somewhat",
                "more direct instruction.  Their class time should have high",
                "teacher supervision, with high supervision even during",
                "independent work opportunities.",
                " ".
        display attach reference14 of kb.
        endif.

secDIR1s19:
        if
        Tlevel = high school
        and Tarea = English
        and achlevel = low
        and DIR lt 0.75
        and DIR ge 0.5
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction,",
                "which is a sound instructional practice for your low stu-",
                "dents.  They benefit from having adequate class time for",
                "completing independent work.",
                " ".
        display attach reference14 of kb.
        endif.

\****************low DIR for language arts and reading starts here

secDIR1ff32:
        if
        Tlevel = junior high ¦ high school
        and Tarea = English
        and achlevel = low
        and DIR lt 0.5
        and DIR ge 0.33
        then DIRval = low  <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your low achievement students still require a high",
                "amount of direct instruction in basic skills.",
                " ".
        display attach reference5 of kb.
        endif.

secDIR1gg33:
        if
        Tlevel = junior high ¦ high school
        and Tarea = English
        and SES = middle class ¦ upper class
        and achlevel = average ¦ high
        and achlevel = average ¦ high
        and DIR lt 0.5
        and DIR ge 0.33
        then DIRval = medium <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your average achievement students should benefit from",
                "somewhat more direct instruction with some class time",
                "reserved for independent work and for occasional small group",
                "interaction.",
                " ".
        display attach reference14 of kb.
        endif.

secDIR1LL38:
        if
        Tlevel = junior high ¦ high school
        and Tarea = English
        and SES = middle class ¦ upper class
        and achlevel = average ¦ high
        and DIR lt 0.5
        and DIR ge 0.33
        then DIRval = high <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should benefit from considerably more",
                "direct instruction.  They need a brisk pace with relatively",
                "little class time for independent work.",
                " ".
        display attach reference3 of kb.
        endif.


\****** end secdir here

secdir1:
        if Tlevel = junior high ¦ high school
        and Tarea = science
        and science focus # labs
        and achlevel = low
        and Tgoal = tests
        and DIR ge 0.75
        then DIRval = low <0.7>.
        message "You are providing a high amount of direct instruction.  Your",
                "students should benefit from somewhat less direct instruc-",
                "tion.  They need class time for completing assignments.",
                " ".
        display attach reference15 of kb.
        endif.

secdir2:
        if Tlevel = junior high ¦ high school
        and Tarea = science
        and science focus # labs
        and achlevel = low
        and Tgoal = tests
        and DIR lt 0.75
        and DIR ge 0.5
        then DIRval = high <0.7>.
        message "You are providing a moderate amount of direct instruction,",
                "which is a sound instructional practice with your students.",
                "They need class time for completing assignments.",
                " ".
        display attach reference14 of kb.
        endif.

secdir3:
        if Tlevel = junior high ¦ high school
        and Tarea = science
        and Tarea = science
        and science focus # labs
        and achlevel = low
        and Tgoal = tests
        and DIR lt 0.5
        and DIR ge 0.33
        then DIRval = low <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  They should benefit from somewhat more direct instruc-",
                "tion.  They need frequent opportunities to respond to teacher",
                "questions.  They also need supervision of their independent",
                "work.",
                " ".
        display attach reference14 of kb.
        endif.

secdir4:
        if Tlevel = junior high ¦ high school
        and Tarea = science
        and science focus # labs
        and achlevel = low
        and Tgoal # tests
        and DIR ge 0.75
        then DIRval = medium <0.5>.
        message "You are providing a high amount of direct instruction.  Your",
                "students should benefit from somewhat less direct instruc-",
                "tion.  Small group interaction and project work are useful",
                "for helping improve students' self-concepts, creativity, and",
                "problem solving.",
                " ".
        display attach reference10 of kb.
        endif.

secdir5:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = low
                and Tgoal # tests
                and DIR lt 0.75
                and DIR ge 0.5
        then DIRval = high <0.5>.
        message "You are providing a moderate amount of direct instruction",
                "which is a sound instructional practice for your students.",
                "Small group interaction and project work are useful for help-",
                "ing improve students' self-concepts, creativity, and problem",
                "solving.",
                " ".
        display attach reference10 of kb.
        endif.

secdir6:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = low
                and Tgoal # tests
                and DIR lt 0.5
                and DIR ge 0.33
        then DIRval = low <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should benefit from somewhat more direct",
                "instruction.  Small group interaction and projects are useful",
                "for helping improve students' self-concepts, creativity, and",
                "problem solving.",
                " ".
        display attach reference10 of kb.
        display attach reference10 of kb.
        endif.

secdir7:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = average
                and SES = upper class ¦ middle class
                and DIR ge 0.75
        then DIRval = high <0.7>.
        message "You are providing a high amount of direct instruction which",
                "is a sound instructional practice with your average achieve-",
                "ment science students when they are not in lab.",
                " ".
        display attach reference1 of kb.
        endif.

secdir8:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = average
                and SES = upper class ¦ middle class
                and DIR lt 0.75
                and DIR ge 0.5
        then DIRval = medium <0.7>.
        message "You are providing a moderate amount of direct instruction.",
                "Your students may benefit from somewhat more direct instruc-",
                "tion.  Frequent opportunities to respond to teacher questions",
                "are important.",
                " ".
        display attach reference14 of kb.
        endif.

secdir9:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = average
                and SES = upper class ¦ middle class
                and DIR lt 0.5
                and DIR ge 0.33
        then DIRval = low <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Considerably more direct instruction is important for",
                "your students.  They need frequent opportunities to respond",
                "to teacher questions.",
                " ".
        display attach reference14 of kb.
        endif.

secdir10:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = average
                and SES = poor
                and DIR ge 0.75
        then DIRval = medium <0.6>.
        message "You are providing a high amount of direct instruction.",
                "Reducing this amount somewhat should be beneficial for your",
                "students who require some class time to work on independent",
                "assignments.",
                " ".
        display attach reference14 of kb.
        endif.
        endif.

secdir11:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = average
                and SES = poor
                and DIR lt 0.75
                and DIR ge 0.5
        then DIRval = high <0.6>.
        message "You are providing a moderate amount of direct instruction",
                "which is a sound instructional practice for your students.",
                "They benefit from frequent opportunities to respond to",
                "teacher questions and from some class time for independent",
                "work.",
                " ".
        display attach reference14 of kb.
        endif.

secdir12:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = average
                and SES = poor
                and DIR lt 0.5
                and DIR ge 0.33
        then DIRval = low <0.6>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  You should provide somewhat more direct instruction.",
                "Your students should benefit from frequent opportunities to",
                "teacher questions as well as some class time for independent",
                "work.",
                " ".
        display attach reference14 of kb.
        endif.

secdir13:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = high
                and DIR ge 0.75
        then DIRval = high <0.8>.
        message "You are providing a high amount of direct instruction which",
                "is a sound instructional practice for your high achievement",
                "students.",
                " ".
        display attach reference5 of kb.
        endif.

secdir14:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = high
                and DIR lt 0.75
                and DIR ge 0.5
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "Providing somewhat more direct instruction should be bene-",
                "ficial.  Your students should perform well when they experi-",
                "ence a brisk pace of instruction with frequent opportunities",
                "to respond to teacher questions.",
                " ".
        display attach reference[illegible] of kb.
        endif.

secdir15:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus # labs
                and achlevel = high
                and DIR lt 0.5
                and DIR ge 0.33
        then DIRval = low <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should receive considerably more direct",
                "instruction.  They should perform well when they experience",
                "a brisk pace of instruction with frequent opportunities to",
                "respond to teacher questions.",
                " ".
        display attach reference3 of kb.
        endif.

secdir16:

        if Tlevel = junior high ¦ high school
        and Tarea = English ¦ social studies ¦ health education
        and achlevel = low
        and Tgoal = tests
        and DIR ge 0.75
        then DIRval = low <0.7>.
        message "You are providing a high amount of direct instruction.",
                "Reducing direct instruction somewhat may help your low",
                "achievement students who need class time for studying and for",
                "practicing skills.",
                " ".
        display attach reference15 of kb.
        endif.

secdir17:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = low
                and Tgoal = tests
                and DIR lt 0.75
                and DIR ge 0.5
        then DIRval = high <0.7>.
        message "You are providing a moderate amount of direct instruction",
                "which is a sound instructional practice for your students.",
                "Your low achievement students need direct instruction of new",
                "material, but they also need adequate class time for studying",
                "and for practicing skills.",
                " ".
        display attach reference1 of kb.
        display attach reference14 of kb.
        display attach reference15 of kb.
        endif.

secdir18:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = low
                and Tgoal = tests
                and DIR lt 0.5
                and DIR ge 0.33
        then DIRval = low <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should benefit from somewhat more direct",
                "instruction.  Frequent opportunities to respond to teacher",
                " ".
        display attach reference1 of kb.
        display attach reference14 of kb.
        endif.

secdir19:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = low
                and Tgoal # tests
                and DIR ge 0.75
        then DIRval = medium <0.5>.
        message "You are providing a high amount of direct instruction.  To",
                "help students improve their creativity, problem-solving, and/",
                "or self-concepts, reducing direct instruction somewhat is",
                "useful.",
                " ".
        display attach reference10 of kb.
        endif.

secdir20:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = low
                and Tgoal # tests
                and DIR lt 0.75
                and DIR ge 0.5
        then DIRval = high <0.5>.
        message "You are providing a moderate amount of direct instruction",
                "which is a sound instructional practice for your students.",
                "When your teaching goal relates to improving students' crea-",
                "tivity, problem-solving, or self-concepts, providing time",
                "for small group project work is useful.  An 'open teaching'",
                "style is helpful.",
                " ".
        display attach reference10 of kb.
        endif.

secdir21:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = low
                and Tgoal # tests
                and DIR lt 0.5
                and DIR ge 0.33
        then DIRval = low <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should benefit from having somewhat less",
                "direct instruction when your teaching goal relates to impro-",
                "ving students' creativity, problem-solving, or creativity.",
                "In this case small group project work is useful.  An 'open'",
                "teaching style is helpful.",
                " ".
        display attach reference10 of kb.
        endif.

secdir22:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = average
                and SES = upper class ¦ middle class
                and DIR ge 0.75
        then DIRval = high <0.7>.
        message "You are providing a high amount of direct instruction which",
                "is a sound instructional practice for your students.",
                " "
        display attach reference13 of kb.
        display attach reference14 of kb.
        endif.

secdir23:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = average
                and SES = upper class ¦ middle class
                and DIR lt 0.75
                and DIR ge 0.5
        then DIRval = medium <0.7>.
        message "You are providing a moderate amount of direct instruction.",
                "Your students should benefit from somewhat more direct",
                "instruction.  Providing frequent opportunities to respond",
                "to teacher questions is helpful.",
                " ".
        display attach reference13 of kb.
        display attach reference14 of kb.
        endif.

secdir24:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = average
                and SES = upper class ¦ middle class
                and DIR lt 0.5
                and DIR ge 0.33
        then DIRval = low <0.7>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students may benefit from considerably more",
                "direct instruction.  Providing frequent opportunities to",
                "respond to teacher questions is helpful.",
                " ".
        display attach reference12 of kb.
        display attach reference13 of kb.
        endif.

secdir25:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = average
                and SES = poor
                and DIR ge 0.75
        then DIRval = medium <0.6>.
        message "You are providing a high amount of direct instruction.  Your",
                "students should benefit from somewhat less direct instruction",
                "Class time for independent work and for small group inter-",
                "action should be useful for them.",
                " ".
        display attach reference14 of kb.
        endif.

secdir26:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = average
                and SES = poor
                and DIR lt 0.75
                and DIR ge 0.5
        then DIRval = high <0.6>.
        message "You are providing a moderate amount of direct instruction",
                "which is a sound instructional practice for your students.",
                "Class time for independent work and for small group inter-",
                "action should be useful for them.",
                " "
        display attach reference14 of kb.
        endif.

secdir27:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = average
                and SES = poor
                and DIR lt 0.5
                and DIR ge 0.33
        then DIRval = low <0.6>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should benefit from somewhat more direct",
                "instruction.  Providing them with frequent opportunities to",
                "to respond to teacher questions will be helpful.",
                " ".
        display attach reference13 of kb.
        display attach reference14 of kb.
        endif.

secdir28:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = high
                and DIR ge 0.75
        then DIRval = high <0.8>.
        message "You are providing a high amount of direct instruction which",
                "is a sound instructional practice for your students.",
                " ".
        display attach reference12 of kb.
        display attach reference13 of kb.
        endif.

secdir29:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = high
                and DIR lt 0.75
                and DIR ge 0.5
        then DIRval = medium <0.8>.
        message "You are providing a moderate amount of direct instruction.",
                "Your high achievement students may benefit from somewhat",
                "more direct instruction.  A brisk pace with frequent oppor-",
                "tunities to respond to questions is important.",
                " ".
        display attach reference3 of kb.
        endif.

secdir30:
        if Tlevel = junior high ¦ high school
                and Tarea = English ¦ social studies ¦ health education
                and achlevel = high
                and DIR lt 0.5
                and DIR ge 0.33
        then DIRval = low <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your high achievement students may benefit from con-",
                "siderably more direct instruction.  A brisk pace with",
                "frequent opportunities to respond to questions is important.",
                " ".
        display attach reference3 of kb.
        endif.

secdir31:
        if Tlevel = junior high ¦ high school
                and Tarea = science
```

```
          and science focus = labs
          or Tarea = art ¦ home economics ¦ industrial arts
                  ¦ physical education
          and achlevel = high ¦ average
          and DIR ge 0.75
        then DIRval = low <0.8>.
        message "You are providing a high amount of direct instruction which",
          "is inappropriate for lab type classes.  Your students should",
          "benefit from considerably less direct instruction.  They",
          "require adequate class time for practicing skills.",
          " ".
        display attach reference14 of kb.
        endif.

secdir32:
        if Tlevel = junior high ¦ high school
          and Tarea = science
          and science focus = labs
          or Tarea = art ¦ home economics ¦ industrial arts
                  ¦ physical education
          and achlevel = high ¦ average
          and DIR lt 0.75
          and DIR ge 0.50
        then DIRval = low <0.8>.
        message "You are providing a moderate amount of direct instruction.",
          "Your students should benefit from considerably less direct",
          "instruction.  They require adequate class time for practicing",
          "skills.",
          " ".
        display attach reference14 of kb.
        endif.

secdir33:
        if Tlevel = junior high ¦ high school
          and Tarea = science
          and science focus = labs
          or Tarea = art ¦ home economics ¦ industrial arts
                  ¦ physical education
          and achlevel = high ¦ average
          and DIR lt 0.50
          and DIR ge 0.33
        then DIRval = medium <0.8>.
        message "You are providing a relatively low amount of direct instruc-",
          "tion which is still somewhat too high for activity-oriented",
          "classes.  Your students require adequate class time for prac-",
          "ticing skills.",
          " ".
        display attach reference14 of kb.
        endif.

secdir34:
        if Tlevel = junior high ¦ high school
          and Tarea = science
          and science focus = labs
          or Tarea = art ¦ home economics ¦ industrial arts
                  ¦ physical education
          and achlevel = high ¦ average
          and DIR lt 0.33
        then DIRval = high <0.8>.
        message "You are a very low amount of direct instruction which is a",
          "should instructional practice for students in your activity-",
          "oriented class.",
          " ".
        display attach reference14 of kb.
        endif.
```

```
secdir35:
        if Tlevel = junior high ¦ high school
                and Tarea = art ¦ physical education
                and achlevel = low
                and DIR ge 0.75
        then DIRval = medium  <0.6>.
        message "You are providing a high amount of direct instruction.  Your",
                "low achievement students should benefit from somewhat less",
                "direct instruction.  They require a lot of guided practice",
                "but also some time for independent practice.",
                " ".
        display attach reference14 of kb.
        endif.

secdir36:
        if Tlevel = junior high ¦ high school
                and Tarea = art ¦ physical education
                and achlevel = low
                and DIR lt 0.75
                and DIR ge 0.50
        then DIRval = high  <0.6>.
        message "You are providing a moderate amount of direct instruction",
                "which is a sound instructional practice for your low achieve-",
                "ment students.  They require a lot of guided practice but",
                "also some time for independent practice.",
                " ".
        display attach reference14 of kb.
        endif.

secdir37:
        if Tlevel = junior high ¦ high school
                and Tarea = art ¦ physical education
                and achlevel = low
                and DIR lt 0.50
                and DIR ge 0.33
        then DIRval = medium  <0.6>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your low achievement students should benefit from",
                "somewhat more direct instruction.  They require a lot of",
                "guided practice but also some time for independent practice.",
                " ".
        display attach reference14 of kb.
        endif.

secdir38:
        if Tlevel = junior high ¦ high school
                and Tarea = art ¦ physical education
                and achlevel = low
                and DIR lt 0.33
        then DIRval = low  <0.6>.
        message "You are providing a very low amount of direct instruction.",
                "Your students require considerably more direct instruction.",
                "They need a lot of guided practice.".
        endif.

secdir39:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus = labs
                or Tarea = home economics ¦ industrial arts
                and achlevel = low
                and DIR ge 0.75
        then DIRval = high <0.6>.
        message "You are providing a high amount of direct instruction which",
                "is a sound instructional practice for your students.  They",
                "will benefit from a lot of class supervision and guided"
                "will benefit from a lot of class supervision and guided",
                "practice.",
                " ".
        display attach reference14 of kb.
        endif.

secdir40:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus = labs
                or Tarea = home economics ¦ industrial arts
                and achlevel = low
                and DIR lt 0.75
                and DIR ge 0.50
        then DIRval = medium <0.6>.
        message "You are providing a moderate amount of direct instruction.",
                "Your low achievement students will benefit from somewhat more",
                "direct instruction.  They need a lot of close supervision and",
                "guided practice.",
                " ".
        display attach reference14 of kb.
        endif.

secdir41:
        if Tlevel = junior high ¦ high school
                and Tarea = science
                and science focus = labs
                or Tarea = home economics ¦ industrial arts
                and achlevel = low
                and DIR lt 0.50
        then DIRval = low <0.6>.
        message "You are providing a relatively low amount of direct instruc-",
                "tion.  Your students should benefit from considerably more",
                "direct instruction.  They need a lot of class supervision and",
                "guided practice.",
                " ".
        display attach reference14 of kb.
        endif.

speddir:
        if Tarea = special education
        then
        message "This system was developed for regular education",
        "teachers whose classrooms include mainstreamed special education",
        "students.  You probably will not find the questions or the",
        "recommendations appropriate for you.  If you would like to",
        "continue using the SNAP system, you will have to begin again",
        "and use one of the other subject areas when you are asked for",
        "this information.".
        endif.

DIRa:
        if DIRval = high
        then DIRprob = none.
        endif.

DIRb:
        if DIRval = medium
        and achlevel = average ¦ high
        then DIRprob = none.
        endif.

DIRd:
        if DIRval = medium
        and achlevel = low
        and Tlevel = junior high ¦ high school
        and DIR ge 0.75
        then DIRprob = high.
        endif.

DIRf:
        if DIRval = medium
        and achlevel = low
        and Tlevel = junior high ¦ high school
        and DIR lt 0.5
        then DIRprob = low.
        endif.

DIRg:
        if DIRval = low
        and DIR ge 0.7
        then DIRprob = high.
        endif.

DIRi:
        if DIRval = low
        and Tlevel = junior high ¦ high school
        and DIR lt 0.5
        then DIRprob = low.
        endif.

%

actions:

message " ",
" ",
" ",
" ",
" ",
" ",
" ",
" ",
"                                 Welcome ",
"                                 to the ",
"                      Teacher Effectiveness Planner ",
" ",
" ",
" ",
" ",
" ".
break.
message " ",
        " ",
        " ",
"       This system will help to determine what types of training options",
"the system should recommend for you based upon the research literature on ",
"teacher effectiveness.  Three areas of teaching practice have been ",
"included in the present system:  academic learning time, direct instruction,",
"and questioning.  The system will ask you questions about your students,",
"your classroom, your school,  your common teaching practices, and your",
"interpretation of your students'learning needs.  In addition, you will be",
"asked to enter data from the self observations you have already completed.",
" ",
"       For some of the questions, the answers are very specific, such as ",
" 'What grade do you teach?' For other questions, the answers will require",
"some serious thought on your part.  For example, one of the questions you",
"may be asked is 'What is your most important teaching goal?'.  While we ",
"understand that teachers almost always have more than one goal in mind for",
"any single teaching activity, the system is not yet sophisticated enough ",
"to consider all the complexity that goes into teaching.  We ask that you",
"try to determine, to the best of your ability, the best answer to the",
question that most accurately describes you as a teacher.

break.

message " ",
" ",
" ",
" ",
"     You have already been given some brief instructions about using the",
"SNAP system on the computer, but in case you need a few reminders, here are",
"a few things you should remember:  ",
" ",
"        1.  Whenever you see 'ready for command', you can do one of",
"            the following:  type 'continue', type 'explain' ",
"            if you would like an explanation of the question or one of the ",
"            answer choices, or type 'freeze <your name>' to stop the SNAP ",
"            system and allow you to return to it at a  later time.",
" ",
"        2.  If you are asked a questions that allows you to choose more ",
"            than one answer,  connect your choices with  the '&' symbol.",
" ",
"        3.  If you do not know an answer and cannot figure out an answer",
"            that makes sense, you may enter 'unknown' for any question,",
"            but this will result in poor response by the computer system.",
"            You will be better off simply choosing one of the possible ",
"            answer choices given to you.",
" ",
" ".
break.

message " ".

message " The SNAP system will now use the part of its knowledge base",
        "on teacher effectiveness that deals with the amount of direct",
        "instruction provided in a classroom.  The information used to ",
        "determine whether you are providing the amount of direct instruction",
        "that research would indicate is good for your situation will come",
        "from data that you enter from Observation 1 (giving amounts of time",
        "that the students were in your classroom and amounts of time that",
        "you were teaching them), from additional questions that the ",
        "computer will ask you, and from drawing inferences from this data.",
" ",
" ",
" ",
" ",
" ".
break.
message "First the system will determine the amount of time that is allocated",
        "for instruction on an average school day.".
obtain alloctm.
message "The amount of allocated time (in minutes) on an average day is: ".
display value of alloctm.
break.

message "Now the system will determine the amount of time that is spent in",
        "providing direct instruction to students in your classroom.".
obtain teachtm.
message "The amount of teaching time (in minutes) on an average day is:".
display value of teachtm.
break.

message "Now the system will determine how well your direct instruction ratio",
        "(DIR) matches what would be suggested as ideal by researchers.".
obtain DIR.
message "Your Direct Instruction Ratio (DIR) is:      ".
display value of DIR.
message "This is the ratio of teaching time to allocated time."
```

```
break.

obtain DIRval .

message "The amount of direct instruction you provide in your classroom is" .
display value of DIRval .
break.

message "If you would like to see the rule that the system used to evaluate ",
        "your Direct Instruction Ratio, type JUSTIFY DIRval".
break.

obtain DIRprob.
message  "Your training needs related to direct instruction are as follows: ".
display value of DIRprob.
message "You can interpret these as follows:                                ",
        " 'none' means that you have no particular training needs          ",
        "              related to direct instruction;                      ",
        " 'high' means that you are using too much direct instruction;    ",
        "''low' means that you are not providing enough direct instruction".
write "a:dir.dta", DIR, DIRval, DIRprob.
break.


message "You are now finished with this section of the SNAP system.  To",
"go on to the next section, you will have to exit from this part of the ",
" SNAP system by typing 'stop'.  Then, when you have the C prompt,       ",
"type 'kesr altkb.pkb'".

break.
%
```

```
text:  {certification:  "This knowledge base was written by Jackie",
        "Haynes in July, 1985."}

        {explanation:
"This is a knowledge base to evaluate the amount of academic learning",
"time taking place in a classroom.  It uses the research literature",
"to determine values for the attribute ALT, which is determined by",
"success level, allocated time, and engaged time.   It includes references",
"to literature on ALT evaluating how much ALT is taking place and how",
"helpful it is to a teacher's particular teaching situation. "}
%
attributes:

alloctm: real
        [constraint:  alloctm ge 0.0 and alloctm le 600.0]
        {explain:  "is the total amount of time that COULD",
        "be used for instruction.  It excludes time used for recess, lunch,",
        "school plays, transition from one class to another, etc. "}
        {definition: "The amount of time students are in their classroom in a",
                "given school day"}.

schoolday:  real
        [constraint:  schoolday ge 0.0 and schoolday le 600.0]
        {question:  "How long is the average school day (in minutes)?"}
        {definition:  "the length (in minutes) of an average school day"}.

allocrate:  real
        [constraint:  allocrate ge 0.0 and allocrate le 1.0]
        [calculation:  alloctm / schoolday].

allocval:  sgl
        (high, medium, low)
        {explain:  "The value of the amount of allocated time"}.

engagrate_hi:  real
        [constraint:  engagrate_hi ge 0.0 and engagrate_hi le 1.0].

engagrate_med:  real
        [constraint:  engagrate_med ge 0.0 and engagrate_med le 1.0].

engagrate_low:  real
        [constraint:  engagrate_low ge 0.0 and engagrate_low le 1.0].

engagrateA:  real
        [calculation: engagrate_hi + engagrate_med + engagrate_low].
engagrate:  real
        [constraint:  engagrate ge 0.0 and engagrate le 1.0]
        [calculation: engagrateA / 3].

classperiod:  int
        [constraint:  classperiod ge 30 and classperiod le 90]
        {question:  "How long is a single teaching period in your school?"}.

engagtimeval:  sgl
        (high, medium, low)
        {explain:  "An evaluation of the amount of engaged time"}.

succlev:  sgl
        (high {explain:  "succlev ge 0.85"},
         medium {explain:  "succlev lt 0.85 and ge 0.70"},
          low (explain:  "succlev lt .70"})
         {explain:  "The amount of success experienced by students is",
                 "an important variable in teacher effectiveness."}.

succlev_high:  sgl
         (high
         {question:  "above 85% correct"},
          medium
         {question:  "between 70% and 85% correct"},
          low
         {question:  "less than 70% correct"})
         {explain:  "The amount of success experienced by students is",
                 "an important variable in teacher effectiveness."}
         {question:  "From Observation 3, how would you rate the success",
                     "level of the high students you observed?"}.
succlev_med:  sgl
         (high
         {question:  "above 85% correct"},
          medium
         {question:  "between 70% and 85% correct"},
          low
         {question:  "less than 70% correct"})
         {explain:  "The amount of success experienced by students is",
                 "an important variable in teacher effectiveness."}
         {question:  "From Observation 3, how would you rate the success",
                     "level of the average students you observed?"}.

succlev_low:  sgl
         (high
         {question:  "above 85% correct"},
          medium
         {question:  "between 70% and 85% correct"},
          low
         {question:  "less than 70% correct"})
         {explain:  "The amount of success experienced by students is",
                 "an important variable in teacher effectiveness."}
         {question:  "From Observation 3, how would you rate the success",
                     "level of the low students you observed?"}.

Qsucclev_H: sgl
         (high, medium, low).

Qsucclev_M:  sgl
         (high, medium, low).

Qsucclev_L:  sgl
         (high, medium, low).

Successes_H: int.

Successes_M: int.

Successes_L: int.

Responses_H: int.

Responses_M:  int.

Responses_L:  int.

highS:  int.
mediumS:  int.
lowS:  int.
totalS:  int.

Opprespond_H: int
```

```
Oppreśpond_M: int.

Opprespond_L: int.

Opprespond_tot:  int.

succrate_high:  real.

succrate_med:  real.

succrate_low:  real.

indepsucclev:  sgl
        (high, medium, low).

successprob_high: sgl
        (present, absent).

successprob_med:  sgl
        (present, absent).

successprob_low:  sgl
        (present, absent).

successprob:  sgl
        (present, absent).

ALT: sgl
        (high, medium, low)
        (explain:  "ALT is based on the value of success level",
                   " (succlev), allocated time (alloctm), and",
                   " engaged time (engagtime).").

ALTprob:  mlt
        (none, successlev, allocated_time, engaged_time, info)
        (explain: "ALTprob means there is a problem with ALT").

%
externals:

        obs2:
                [program:  "ob2"]
                [outputs: succrate_high, succrate_med,
                    succrate_low]
                [outputfile:  "ob2.dta"].
        obs3:
                [program:  "ob3"]
                [outputs:  engagrate_hi, engagrate_med, engagrate_low,
                        succlev_high, succlev_med, succlev_low]
                [outputfile:  "ob3.dta"].
%

rules:

\the cut-off points for engagement rates are designed to be very
\stringent in assignment of HIGH , since it is assumed that the data
\obtained thru self-observation are going to be inflated.  The inflation
\may be due to the bias of teachers selecting favorable times to observe
\or simply because teachers will usually (we assume) be observing their
\students at seatwork which students know will be collected and graded
\(so teachers can evaluate their succlev).

engagrate1:
        if engagrate ge 0.90
        then engagtimeval = high <0.9>
        endif.
\fatbook, BTES p.353

engagrate2:
        if engagrate lt 0.90
        and engagrate ge 0.65
        then engagtimeval = medium <0.8>.
        endif.
\fatbook, p.353
engagrate3:
        if engagrate lt 0.65
        then engagtimeval = low <0.9>.
        endif.
\fatbook, p.353

alloctm1:
        if allocrate ge 0.65
        then allocval = high <0.9>.
        endif.
\reference BTES fatbook, p.352

alloctm2:
        if allocrate lt 0.65
        and allocrate ge 0.40
        then allocval = medium <0.8>.
        endif.
\reference BTES fatbook, p.352

alloctm3:
        if allocrate lt 0.40
        then allocval = low <0.8>.
        endif.
\reference BTES fatbook, p.352


seatsucclev1:
        if succlev_high = high
        and succlev_med = high
        and succlev_low = high
        then indepsucclev = high.
        endif.

seatsucclev2:
        if succlev_high = high
        and succlev_med = medium
        and succlev_low = high
        then indepsucclev = high.
        endif.

seatsucclev3:
        if succlev_high = high
        and succlev_med = medium
        and succlev_low = medium
        then indepsucclev = medium.
        endif.


seatsucclev4:
        if succlev_high = high
        and succlev_med = medium
        and succlev_low = low
        then indepsucclev = low.
        endif.

seatsucclev5:
        if succlev_high = high
        and succlev_med = low
        and succlev_low = high
        then indepsucclev = medium.
        endif.

seatsucclev6:
        if succlev_high = high
        and succlev_med = low
        and succlev_low = medium
        then indepsucclev = medium.
        endif.

seatsucclev7:
        if succlev_high = high
        and succlev_med = low
        and succlev_low = low
        then indepsucclev = low.
        endif.

seatsucclev8:
        if succlev_high = high
        and succlev_med = high
        and succlev_low = low
        then indepsucclev = medium.
        endif.

seatsucclev9:
        if succlev_high = high
        and succlev_med = high
        and succlev_low = medium
        then indepsucclev = medium.
        endif.

seatsucclev10:
        if succlev_high = medium
        and succlev_med = high
        and succlev_low = high
        then indepsucclev = high.
        endif.

seatsucclev11:
        if succlev_high = medium
        and succlev_med = high
        and succlev_low = low
        then indepsucclev = medium.
        endif.

seatsucclev12:
        if succlev_high = medium
        and succlev_med = high
        and succlev_low = medium
        then indepsucclev = medium.
        endif.

seatsucclev13:
        if succlev_high = medium
        and succlev_med = medium
        and succlev_low = high
        then indepsucclev = medium.
        endif.

seatsucclev14:
        if succlev_high = medium
        and succlev_med = medium
        and succlev_low = medium
        then indepsucclev = medium.
        endif.

seatsucclev15:
        if succlev_high = medium
        and succlev_med = medium
        and succlev_low = low
        then indepsucclev = low.
        endif.

seatsucclev16:
        if succlev_high = medium
        and succlev_med = low
        and succlev_low = high
        then indepsucclev = medium.
        endif.

seatsucclev17:
        if succlev_high = medium
        and succlev_med = low
        and succlev_low = medium
        then indepsucclev = low.
        endif.

seatsucclev18:
        if succlev_high = medium
        and succlev_med = low
        and succlev_low = low
        then indepsucclev = low.
        endif.

seatsucclev19:
        if succlev_high = low
        and succlev_med = high
        and succlev_low = high ¦ medium
        then indepsucclev = medium.
        endif.

seatsucclev20:
        if succlev_high = low
        and succlev_med = high
        and succlev_low = low
        then indepsucclev = low.
        endif.

seatsucclev21:
        if succlev_high = low
        and succlev_med = medium
        and succlev_low = high ¦ medium
        then indepsucclev = medium.
        endif.

seatsucclev22:
        if succlev_high = low
        and succlev_med = medium
        and succlev_low = low
        then indepsucclev = low.
        endif.

seatsucclev23:
        if succlev_high = low
        and succlev_med = low
        and succlev_low = high ¦ medium ¦ low
        then indepsucclev = low.
        endif.

succlev1:
        if succrate_high ge 0.70
        then Qsucclev_H = high <0.9>.
        endif .
\fatbook, p. 341

succlev2:
        if succrate_med ge 0.75
        then Qsucclev_M = high <0.8>.
        endif.
\fatbook, p. 341

succlev3:
        if succrate_low ge 0.80
        then Qsucclev_L = high <0.9>.
        endif.
\fatbook, p. 341

succlev4:
        if succrate_high ge 0.65
        and succrate_high lt 0.70
        then Qsucclev_H = medium <0.8>.
        endif .
\fatbook, p. 341

succlev5:
        if succrate_med ge 0.70
        and succrate_med lt 0.75
        then Qsucclev_M = medium <0.7>.
        endif.
\fatbook, p. 341

succlev6:
        if succrate_low ge 0.75
        and succrate_low lt 0.8
        then Qsucclev_L = medium <0.8>.
        endif.
\fatbook, p. 341

succlev7:
        if succrate_high lt 0.65
        then Qsucclev_H = low  <0.9>.
        endif .
\fatbook, p. 341

succlev8:
        if succrate_med lt 0.70
        then Qsucclev_M = low <0.8>.
        endif.
\fatbook, p. 341

succlev9:
        if succrate_low lt 0.75
        then Qsucclev_L = low <0.9>.
        endif.
\fatbook, p. 341

success1:
        if succlev_high = high ¦ medium
        and Qsucclev_H = high ¦ medium
        then successprob_high = absent.
        endif.

success2:
        if succlev_high = low
        or Qsucclev_H = low
        then successprob_high = present
        endif.

success3:
        if succlev_med = high
        and Qsucclev_M = high
        then successprob_med = absent.
        endif.

success4:
        if succlev_med = medium ¦ low
        and Qsucclev_M = medium ¦ low
        then successprob_med = present.
        endif.

success5:
        if succlev_low = high
        and Qsucclev_L = high
        then successprob_low = absent.
        endif.

success6:
        if succlev_low = medium ¦ low
        and Qsucclev_L = medium ¦ low
        then successprob_low = present.
        endif.

successprob1:
        if successprob_high = absent
        and successprob_med = absent
        and successprob_low = absent
        then successprob = absent.
             succlev = high.
        endif.

successprob2:
        if successprob_high = absent
        and successprob_med = present
        and successprob_low = absent
        then successprob = present.
                succlev = medium.
        endif.

successprob3:
        if successprob_high = absent
        and successprob_med = absent
        and successprob_low = present
        then successprob = present.
                succlev = medium.
        endif.

successprob4:
        if successprob_high = present
        and successprob_med = present
        and successprob_low = present
        then successprob = present.
        succlev = low.
        endif.

successprob5:
        if successprob_high = present
        and successprob_med = absent
        and successprob_low = absent
        then successprob = present.
        succlev = medium.
        endif.
```

```
successprob6:
        if successprob_high = present
        and successprob_med = absent
        and successprob_low = present
        then successprob = present.
        succlev = low.
        endif.

successprob7:
        if successprob_high = absent
        and successprob_med = present
        and successprob_low = present
        then successprob = present.
        succlev = low.
        endif.

successprob8:
        if successprob_high = present
        and successprob_med = present
        and successprob_low = absent
        then successprob = present.
        succlev = medium.
        endif.



\^^alt1
altrule1:
        if succlev = high
        and allocval = high ¦  medium
        and  engagtimeval = high
        then
        ALT = high <1.0>.
        message "The amount of Academic Learning Time available",
                "in your classroom appears to be quite high. ".
        endif.

altrule3:
         if
         succlev = low
         and  allocval = high
         and  engagtimeval = high
         then
         ALT = medium <0.9>.
         message "The lack of success that your students experience",
                        "is probably hindering their academic achievement.",
                        "The activities you are planning are too     ",
                        "difficult for them.  Try making their work easier",
                        "and see if their achievement improves."
        endif.


altrule6:
        if succlev = high
        and  allocval = low
        and  engagtimeval = high
        then
        ALT = high <0.8>.
        message "Although your students appear to be engaged",
                        "in learning tasks at a high rate, the amount",
                        "of time available for instruction seems to be",
                        "somewhat shorter than it should be.  Perhaps",
                        "you could arrange the schedule for your students",
                        "so that they have more time in class for learning."
        endif.
```

```
altrule5:
        if succlev = high
        and  allocval = medium
        and  engagtimeval = medium
        then
        ALT = medium <0.9>.
        message "Although your students are successful in performing",
                "their learning tasks, they are not engaged in those",
                "tasks as much as they should be, nor are they spending",
                "enough time in actual learning situations.  You should",
                "consider whether there are ways to rearrange the schedule",
                "of your school day to provide for more instructional time,",
                "and to consider adopting some instructional and behavior",
                "management techniques to improve the academic learning  ",
                "time of students in your classroom.".
        endif.


altrule6:
        if succlev = high
        and allocval = high
        and engagtimeval = low
        then
        ALT = medium <0.9>.
        message  "You should try to plan instructional and behavior",
                "management activities that will increase the amount",
                "of time your students are engaged in their learning",
                "tasks.".
        endif.



altrule7:
         if succlev = high
         and engagtimeval = medium
         and  allocval = low
         or  succlev = medium
         and engagtimeval = high
         and  allocval = low
         then ALT = medium <0.9>.
         message " Your students appear to be successful in their learning",
                "activities and engaged a good amount of the time ",
                "available for instruction, but they need more instructional",
                "time each school day.  Perhaps you could try to arrange",
                "a schedule that will allow for more instructional  ",
                "time in a school day.".
         endif.


altrule8:
         if allocval = low
         and engagtimeval = low
         then
         ALT = low <1.0>.
        message "You should try to plan for more instructional time",
                "each day and for instructional and behavior management",
                "techniques that will increase the amount of time your",
                "students are engaged in their learning activities.".
         endif.


altrule9:
         if allocval = medium
         and engagtimeval = low
         and succlev = high
         or  succlev = medium
         then
         ALT = medium <0.8>.
        message "Your students need more learning time, either by",
                "increasing their engagement rate, or by increasing",
                "the amount of time available for instruction in the",
                "school day.  Their success level is good, which may",
                "indicate that they are off-task because the work is",
                "too easy for them.".
         endif.

altrule10:
          if
          succlev = low
          and  allocval = low
          and  engagtimeval = high
          then
          ALT = medium <0.9>.
        message "Your student achievement level would probably",
                "improve if they were more successful (their work",
                "was easier for them) and if more time for learning",
                "activities took place each day.".
          endif.

altrule10a:
        if succlev = low
        and allocval = low
        and engagtimeval = medium
        then ALT = low <0.8>.
        message "Your students' achievement level would probably",
        "improve if they were more successful (their work",
        "was easier for them) and if more time for learning",
        "activities took place each day.".
        endif.

altrule11a:
        if succlev = medium
        and engagtimeval = medium
        then ALT = medium <0.9>.
        message "You are combining moderate amounts of success, available",
        "instructional time and a relatively strong engagement rate.",
        "Improving any of these would also improve student achievement.".
         endif.


altrule13:
          if succlev = low
          and  allocval = high
          or  allocval = medium
          and    engagtimeval = medium
         then ALT = medium <0.9>.
        message " You may be able to improve the achievement of your",
                "students by increasing their opportunities to be",
                "successful.  Doing so may help to improve the amount",
                "of engaged time, which should lead to improved learning.".
          endif.


altrule14:
         if succlev = low
         and allocval = medium
         and  engagtimeval = high
         then
         ALT = medium <0.9>.
         message "Your students are on task most of the time, but they",
                "may be frustrated by their inability to do the work that",
                "is required of them.  Their achievement would probably",
                "improve if they were given work at an easier level where",
                "they could be more successful.".
        endif.


altrule15:
         if succlev = low
         and engagtimeval = low
         and
         allocval = high
         or allocval =  medium
         then ALT = low <0.9>.
         message "There appears to be enough instructional time available",
                "each day, but your students are frequently off task and ",
                "not engaged in their learning activities.  Also, they ",
                "seem to have great difficulty with their work.  Student",
                "engaged time may improve if you try to provide them with",
                "more opportunities for success by assigning easier work",
                "and by trying to provide more motivating activities.".
        endif.


altrule17:
         if succlev = medium
         and allocval = high
         and  engagtimeval = low
         then ALT = medium <0.8>.
        message "Although there is a large amount of instructional time",
                "available in your class, your students are not engaged",
                "in their learning tasks very much.  Increasing the amount",
                "of success may help to improve students' engagement rate,",
                "or planning for more direct instruction may help to improve",
                "engagement rate." .
         endif.


altrule18:
         if succlev= high
         and  allocval = high
         and  engagtimeval = medium
         then ALT =high <0.9>.
        message "You are maintaining very high rates of success and available",
                "instructional time.  However, increasing the amount of time",
                "your students are actually on task may help to improve their",
                "achievement levels.".
         endif.

altrule19:
         if succlev= high
         and allocval = low
         and engagtimeval = medium
         then ALT =medium <0.9>.
        message "You are maintaining very high rates of success, but the",
                "amount of time available for instruction is not enough.",
                "Your students' achievement would probably improve if you",
                "try to change the schedule somewhat so that students have ",
                "more time to learn.".
         endif.

altrule20:
         if succlev= medium
         and allocval = medium
         and engagtimeval = high
         then ALT medium <0.9>.
        message "You are maintaining a moderate rate of success with a",
                "moderate amount of instructional time.   By increasing",
                "your students' success level, both their engagement rate",
                "and their achievement level may improve.".
         endif.

altrule21:
         if succlev = medium
         and allocval = medium
         and engagtimeval = low
         then ALT = medium <0.9>.
         message  "You are maintaining a moderate rate of success with a",
                "moderate amount of instructional time, however your ",
                "students are frequently off task.  By providing more",
                "motivating activities, or activities allowing for even",
                "higher success level, their engagement rate may improve.".
         endif.

ALTprob1:
        if ALT = high
        then ALTprob = none.
        endif.

ALTprob2:
        if ALT = medium ¦ low
        and allocval = medium ¦ low
        and successprob = absent
        and engagtimeval = high
        then
        ALTprob = allocated_time & info.
        endif.

ALTprob3:
        if ALT = medium ¦ low
        and allocval = medium ¦ low
        and successprob = present
        and engagtimeval = high
        then ALTprob = allocated_time & successlev & info.
        endif.

ALTprob4:
        if ALT = medium ¦ low
        and allocval = medium ¦ low
        and successprob = absent
        and engagtimeval = medium ¦ low
        then ALTprob = allocated_time & engaged_time & info.
        endif.

ALTprob5:
        if ALT = medium ¦ low
        and allocval = medium ¦ low
        and successprob = present
        and engagtimeval = medium ¦ low
        then ALTprob = allocated_time & engaged_time & successlev & info.
        endif.

ALTprob6:
        if ALT = medium ¦ low
        and allocval = high
        and successprob = present
        and engagtimeval = medium ¦ low
        then ALTprob = engaged_time & successlev & info.
        endif.

ALTprob7:
        if ALT = medium ¦ low
        and allocval = high
```

```
          and successprob = present
          and engagtimeval = high
          then ALTprob = successlev & info.
          endif.

ALTprob8:
          if ALT = medium ¦ low
          and allocval = high
          and successprob = absent
          and engagtimeval = medium ¦ low
          then ALTprob = engaged_time & info.
          endif.

%

actions:

message " ",
" ",
" ",
" ",
" ",
" ",
" ",
" ",
"                                        Welcome ",
"                                        to the ",
"                           Teacher Effectiveness Planner, Part 2 ",
" ",
" ",
" ",
" ",
" ".
break.

message " ",
          "This part of the SNAP system evaluate Academic Learning Time (ALT). ",
          "The concept of ALT includes three important features of instruction",
          "for students:  how much time is available to them for instruction",
          "in their academic subjects, how much of the time they are engaged",
          "in their learning tasks, and how much of the time they are being",
          "successful in their tasks.  A large body of research has found that",
          "achievement is highest when students are on task and extremely",
          "successful for large amounts of the school day.  The SNAP system",
          "recognizes that allocated time is not easy for teachers to change",
          "since they have no effect on the length or number of school days,",
          "on non-academic school activities, or on scheduling of schoolwide",
          "events.  However, the other facets of ALT are more directly in",
          "the control of an individual teacher and therefore were weighed",
          "more heavily in evaluating any given case.  ",
" ",
" ",
" ".
break.
message " The SNAP system will begin evaluating your ALT by determining",
          "the ratio of allocated time to the length of the school day.".

          read "a:time1.dta", allocta.
          obtain allocval.
          message "The amount of allocated time in your teaching situation is: ",
          display value of allocval.
          break.

message "The next step the SNAP system will use to determine your ALT status",
          "is to determine how successful your students are in their daily",
          "classroom assignments.  You will be asked to enter data [illegible]",
        "Observation 2, which includes students' success in a teacher-led",
        "discussion, and from Observation 3, which includes their success",
        "at seatwork.",
" ",
" ",
" ".
        obtain succlev.
        message "The amount of success your students experience at ",
        "seatwork is: ".
        display value of indepsucclev.
        message "The success rate of your high students during discussions is".
        display value of succrate_high.
        message "This rate of success for high students is".
        display value of Qsucclev_H.
        message "The success rate of average students during discussions is".
        display value of succrate_med.
        message "This rate of success for average students is ".
        display value of Qsucclev_M.
        message "THe success rate of low students during discussions is".
        display value of succrate_low.
        message "This rate of success for low students is.".
        display value of Qsucclev_L.
        break.

message "Now the SNAP system will evaluate how much of the time your students"
        "are activly engaged in their learning tasks.  You will be asked to",
        "provide data collected during Observation 3.".
        obtain engagtimeval.
        message "The amount of engaged time observed in your classroom is  ".
        display value of engagtimeval.
        message " ".
        break.

message "Now SNAP is ready to determine a value for ALT.".
        message  " ALT is ".
        display value of ALT.
        break.

        obtain ALTprob.
        message "According to the data you provided and the rules in this",
        "system, your training needs concerning Academic Learning Time are: ".
        display value of ALTprob.
        break.

break.


message "When you are ready to leave this part of the SNAP system, type",
"STOP.  Then, to start the next part dealing with questioning, type",
"next nexquestb.pkb.".


}
```

```
C>
\This is the QUES knowledge base begun 4/7/86

attributes:


schoolday:  real
        [constraint:  schoolday ge 0.0 and schoolday le 600.0]
        {question:  "How long is the average school day (in minutes)?")
        {definition:  "the length (in minutes) of an average school day"}.


classperiod:  int
        [constraint:  classperiod le 90]
        {question:  "How long is a single teaching period in your school?"}.
Opprespond_H:  real.
\from pascal program

Opprespond_M:  real.

Opprespond_L:  real.

Opprespond_tot: real
\total number of responses given by all students in one observation
\from pascal program

opprespond:  sgl
        (high, medium, low)
        {question:  "How many opportunities to respond do students have?"}.

succrate_high:  real
succrate_med:  real
succrate_low:  real
\will come from pascal program, avg of days 2 and 4

indepsucclev:  sgl
        (high, medium, low).

successprob_high: sgl
        (present, absent).
successprob_med:  sgl
        (present, absent).
successprob_low:  sgl
        (present, absent).

successprob:  sgl
        (present, absent).

high2s:  int
        [question:  "How many high students are in the class?"].
medium2s:  int
        [question:  "How many medium students are in the class?"].
low2s:  int
        [question:  "How many low students are in the class?"].
total2s:  int
        [calculation:  high2s + medium2s + low2s ].

Distrib_H:  real
        [calculation:  high2s / total2s].
Distrib_M:  real
        [calculation:  medium2s / total2s]
```

```
Distrib_L:  real
        [calculation:  lowSs / totalSs].

Responses_H:  real
        {question:  "How many responses did high students make?"}.
Responses_M:  real
        {question:  "How many responses did medium students make?"}.
Responses_L:  real
        {question:  "How many responses did low students make?"}.
Responses_tot:  real
        [calculation:  Responses_H + Responses_M + Responses_L].

RespDistrib_H:  real
        [calculation:  Responses_H / Responses_tot].
RespDistrib_M:  real
        [calculation:  Responses_M / Responses_tot].
RespDistrib_L:  real
        [calculation:  Responses_L / Responses_tot].

oppratio_H:  real
        [calculation:  RespDistrib_H / Distrib_H].
oppratio_M:  real
        [calculation:  RespDistrib_M / Distrib_M].
oppratio_L:  real
        [calculation:  RespDistrib_L / Distrib_L].

LowOpp:  sgl
         (toohigh, OK, toolow)
        {question:  "The proportion of responses made by low students is:"}.
MediumOpp:  sgl
          (toohigh, OK, toolow)
        {question:  "The proportion of responses made by medium students is:"}.
HighOpp:  sgl
          (toohigh, OK, toolow)
        {question:  "The proportion of responses made by high students is:"}.

distribprob:  mlt
        (highS, mediumS, lowS, none).
\values = high, medium, and low students not getting enough questions

responseprob:  sgl
        (present, absent).


qskill:  sgl
        (excellent, good, fair, poor)
        {question:  "How good is the teacher at asking questions in a ",
                "manner that distributes response opportunities fairly ",
                "provides for students' success, and asks questions ",
                "at a rate appropriate for the specific instructional group."}.


respdistrib:  sgl
        (even, high students, low students, average students, other).


quesprob:  mlt
        (highS, mediumS, lowS, none, info, response_opp).
$


\KNOWLEDGE BASE:  QSKILL2.PS (a knowledge base to determine a teacher's
\                              skills at questioning)

rules:
```

```
respdistrib1:
        if oppratio_H gt 1.25
        then HighOpp = toohigh.
        message "You appear to be directing too many questions to your high",
                "achievement students, which indicates that the other groups",
                "are not having sufficient opportunities to respond.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib2:
        if oppratio_H lt 0.75
        then HighOpp = toolow.
        message "You are not directing sufficient questions to your high",
                "achievement students.  Increasing their opportunities to",
                "respond may improve their performance.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib3:
        if oppratio_H le 1.25
        and oppratio_H ge 0.75
        then HighOpp = OK.
        message "Your high achievement students are having sufficient oppor-",
                "tunities to respond to questions.  Opportunity to respond",
                "to question is possitively related to achievement.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib4:
        if oppratio_M gt 1.25
        then MediumOpp = toohigh.
        message "Your average achievement students are having to many oppor-",
                "tunities to respond to questions.  Other students need",
                "sufficient opportunities to respond as well.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib5:
        if oppratio_M lt 0.75
        then MediumOpp = toolow.
        message "Your average achievement students are not having enough",
                "opportunities to respond to questions.  To improve their",
                "achievement, you should provide more opportunities to",
                "respond.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib6:
        if oppratio_M le 1.25
        and oppratio_M ge 0.75
        then MediumOpp = OK.
        message "Your average achievement students are having sufficient",
                "opportunities to respond to questions.  Opportunity to res-",
                "pond to questions is positively related to achievement.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib7:
        if oppratio_L gt 1.25
        then LowOpp = toohigh.
        message "Your low achievement students are having too many oppor-",
                "tunities to respond to questions.  Other students need",
                "sufficient opportunities to respond as well.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib8:
        if oppratio_L lt 0.75
        then LowOpp = toolow.
        message "Your low achievement students are not having enough oppor-",
                "tunities to respond to questions.  To improve their achieve-",
                "ment, you should provide more opportunities to respond.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib9:
        if oppratio_L le 1.25
        and oppratio_L ge 0.75
        then LowOpp = OK.
        message "Your low achievement students are having sufficient oppor-",
                "tunities to respond to questions.  Opportunity to respond",
                "to questions is positively related to achievement.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib10:
        if LowOpp = OK
        and MediumOpp = OK
        and HighOpp = OK
        then distribprob = none.
        message "You are not observed as having a problem with the distribu-",
                "tion of questions among the high, medium, and low achievement",
                "groups in your class.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib11:
        if LowOpp = OK | toohigh
        and MediumOpp = OK
        and HighOpp = toohigh
        then distribprob = none.
        message "You are not observed as having a problem with the distribu-",
                "tion of questions among the high, medium, and low achievement",
                "groups in your class.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib12:
        if LowOpp = OK | toohigh
        and MediumOpp =  OK
        and HighOpp = toolow
        then distribprob = high3.
        message "Your high achievement students are not having sufficient",
                "opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib13:
        if LowOpp = OK | toohigh
        and MediumOpp = toohigh
        and HighOpp = toohigh
        then distribprob = none.
        message "You are not observed as having a problem with the distribu-",
                "tion of questions among the high, medium, and low achievement",
                "groups in your class.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib14:
        if LowOpp = OK ¦ toohigh
        and MediumOpp = toolow
        and HighOpp = toolow
        then distribprob = mediumS & highS.
        message "Your average and high achievement students are not having",
                "sufficient opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib15:
        if LowOpp = OK ¦ toohigh
        and MediumOpp = toohigh
        and HighOpp = toolow
        then distribprob = highS.
        message "Your high achievement students are not having sufficient",
                "opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib16:
        if LowOpp = OK ¦ toohigh
        and MediumOpp = toolow
        and HighOpp = toohigh
        then distribprob = mediumS.
        message "Your average achievement students are not having sufficient",
                "opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib17:
        if LowOpp = OK ¦ toohigh
        and MediumOpp = toohigh
        and HighOpp = OK
        then distribprob =  none.
        message "You are not observed as having a problem with the distribu-",
                "tion of questions among the high, medium, and low achievement",
                "groups in your class.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib18:
        if LowOpp = OK ¦ toohigh
        and MediumOpp = toolow
        and HighOpp = OK
        then distribprob = mediumS.
        message "Your average achievement students are not having sufficient",
                "opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.
```

```
respdistrib19:
        if LowOpp = toolow
        and MediumOpp = OK
        and HighOpp = toohigh
        then distribprob = lowS.
        message "Your low achievement students are not having sufficient",
                "opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib20:
        if LowOpp = toolow
        and MediumOpp =  OK
        and HighOpp = toolow
        then distribprob = highS & lowS.
        message "Your high and low achievement students are not having",
                "sufficient opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib21:
        if LowOpp = toolow
        and MediumOpp = toohigh
        and HighOpp = toohigh
        then distribprob = lowS.
        message "Your low achievement students are not having sufficient",
                "opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib22:
        if LowOpp = toolow
        and MediumOpp = toolow
        and HighOpp = toolow
        then distribprob = mediumS & highS & lowS.
        message "Students in high, medium, and low achievement groups are not",
                "having sufficient opportunities to respond to questions.",
                " ".
        endif.

respdistrib23:
        if LowOpp = toolow
        and MediumOpp = toohigh
        and HighOpp = toolow
        then distribprob = highS & lowS.
        message "Your high and low achievement students are not having",
                "sufficient opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib24:
        if LowOpp = toolow
        and MediumOpp = toolow
        and HighOpp = toohigh
        then distribprob = mediumS & lowS.
        message "Your average and low achievement students are not having",
                "sufficient opportunities to respond to questions.",
                " ".
        display attach reference3 of kb.
        endif.

respdistrib25:
        if LowOpp = toolow
        and MediumOpp = toohigh
        and HighOpp = OK
        then distribprob = low%.
        message "Your low achievement students are not having sufficient",
                "opportunities to respond to questions.",
                " ".
        display attach reference} of kb.
        endif.

respdistrib26:
        if LowOpp = toolow
        and MediumOpp = toolow
        and HighOpp = OK
        then distribprob = medium% & low%.
        message "Your average and low achievement students are not having",
                "sufficient opportunities to respond to questions.",
                " ".
        display attach reference} of kb.
        endif.

opprespond1:
        if Opprespond_tot ge 24
        then opprespond = high.
        message "Students in your class appear to have high opportunity to",
                "respond to questions which is an aspect of effective",
                "teaching.",
                " ".
        display attach reference} of kb.
        endif.
\fatbook, p34}

opprespond2:
        if Opprespond_tot lt 24
        and Opprespond_tot gt 3.5
        then opprespond = medium.
        message "Students in your class appear to have moderate opportunities",
                "to respond to questions.  Increasing this amount should help",
                "your class achieve better.
                " ".
        display attach reference} of kb.
        endif.
\fatbook, p.34}

opprespond3:
        if Opprespond_tot le 3.5
        then opprespond = low.
        message "Students in your class appear to have low opportunity to",
                "respond to questions.  Increasing this amount considerably",
                "should help your class achieve better.  Research indicates",
                "the importance of providing students with frequent oppor-",
                "tunities to respond to questions.",
                " ".
        display attach reference} of kb.
        endif.
\fatbook, p.34}

respprob1:
        if opprespond = high
        then responseprob = absent.
        endif.
respprob2:
        if opprespond = medium | low
        then responseprob = present.
        endif.
```

```
quesprob3:
        if responseprob = absent
        and distribprob = highS
        then quesprob = highS & info.
        endif.
quesprob4:
        if responseprob = absent
        and distribprob = highS & mediumS
        then quesprob = highS & mediumS & info.
        endif.
quesprob5:
        if responseprob = absent
        and distribprob = highS & mediumS & lowS
        then quesprob = highS & mediumS & lowS & info.
        endif.
quesprob6:
        if responseprob = absent
        and distribprob = none
        then quesprob = none.
        endif.
quesprob7:
        if responseprob = absent
        and distribprob = highS & lowS
        then quesprob = highS & lowS & info.
        endif.
quesprob8:
        if responseprob = absent
        and distribprob = mediumS & lowS
        then quesprob = mediumS & lowS & info.
        endif.
quesprob9:
        if responseprob = absent
        and distribprob = mediumS
        then quesprob = mediumS & info.
        endif.
quesprob10:
        if responseprob = absent
        and distribprob = lowS
        then quesprob = lowS & info.
        endif.

quesprob11:
        if responseprob = present
        and distribprob = highS
        then quesprob = highS & info & response_opp.
        endif.
quesprob12:
        if responseprob = present
        and distribprob = highS & mediumS
        then quesprob = highS & mediumS & info & response_opp.
        endif.
quesprob13:
        if responseprob = present
        and distribprob = highS & mediumS & lowS
        then quesprob = highS & mediumS & lowS & info & response_opp.
        endif.
quesprob14:
        if responseprob = present
        and distribprob = none
        then quesprob = response_opp & info.
        endif.
quesprob15:
        if responseprob = present
        and distribprob = highS & lowS
        then quesprob = highS & lowS & info & response_opp.
        endif
```

```
quesprob16:
        if responseprob = present
        and distribprob = mediumS & lowS
        then quesprob = mediumS & lowS & info & response_opp.
        endif.
quesprob17:
        if responseprob = present
        and distribprob = mediumS
        then quesprob = mediumS & info & response_opp.
        endif.
quesprob18:
        if responseprob = present
        and distribprob = lowS
        then quesprob = lowS & info & response_opp.
        endif.

%

actions:
message "This part of SNAP evaluates whether or not you are asking an",
        "adequate number of questions in general (referred to in the ",
        "resesarch literature as 'opportunities to respond,' and whether",
        "or not you are distributing these opportunities equitably among",
        "students of differing ability levels.  The program uses information",
        "you entered from observations 2 and 3 to determine these ratings.".

break.

read "obs2.dta", Successes_H, Successes_M, Successes_L,
                 Opprespond_H, Opprespond_M, Opprespond_L, Opprespons_tot,
                 succrate_high, succrate_med, succrate_low,
                 Responses_H, Responses_M, Responses_L,
                 highS, mediumS, lowS, totalS.

message " First the system will determine your patterns of response",
        "distribution.".
obtain distribprob.
message "Your training needs regarding response distribution are for the",
        "following type(s) of students:".
display value of distribprob.
break.

message "Now the SNAP system will examine the opportunities to respond in",
        "your classroom, according to the data you have provided.".
obtain responseprob.
message "Your training needs regarding opportunities to respond are:".
display value of responseprob.
break.

obtain quesprob.
message "The following list displays the areas dealing with questioning",
        "that the SNAP system believes are important to provide for you.".
display value of quesprob.
break.
%
```

Appendix L

Charts of Research on Effective Instruction

CATEGORY: Time Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
						Achievement		Affect		Other	
	Grade	SES	Achieve. Level	Subj.		ST	LT	School	Self		
Rosenshine, 1980 BTES (focus on "engaged time")	2 & 5		Average (25th to 65% ile)	Basic skills -reading -lang. arts -math	1. High effectiveness teachers					-Time engaged: 2nd grade: 1 hr. 55 min. 5th grade: 2 hrs. 30 min.	
					Average effectiveness teachers					-2nd grade: 1 hr. 30 min. 5th grade: 1 hr. 55 min.	
				Reading	2. Allocation of more time					-increased engagement time	
				Math	Allocation of more time					-zero correlation with engagement time.	
					3. when seatwork is dominant (66% reading; 75% math):						
					teacher- leading groups					84% engagement rate	
					seatwork					70% engagement rate	
					when amount of time for seatwork is very high (e.g. 90%)					engagement drops, esp. in math	
					4. Teachers with highest engaged min.					4 min. off-task per hour	excluding time spent for transitions, housekeeping, etc.- same for high & ave. teachers
					Teachers with average engaged min.					8 min. off-task per hour	

CATEGORY: Time Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Rosenshine, 1980 BTES CONTINUED					5. Group work having substantive interactions (such as questions, answers, feedback, and explanations) including practice and corrections Substantive interactions during seatwork					Increased engagement during seatwork. Increased engagement during seatwork	
					6. Long periods of break time (e.g., recess, lunch, bathroom)					Decreased engaged time- "play" seems to carry over and disrupt engagement during "work"	
Fisher, Becliner, Filby, Marliane, Cahen, Dishaw, & Moore, 1978 BTES focus on Academic learning time- the amount of time a student spends engaged in an academic task that he or she can perform with high success.	2&5		Average (25th to 65th% ile)	Basic skills -reading -lang. arts -math	Optimum behaviors: 1. High amount of time allocated to instruction in a content area (process-product correlation) 2. High amount of time allocated to instruction accompanied by high amount of student engaged time (process-product correlation)	high achievement					Criticism: ALT as described largely ignores the relationship between learning and ALT. Griffin, G.A. Webb N.M., & Confrey,J. Time to learn reviews from three perspectives. The Elem. Sch. J., Sept. 1981, 76-91.

CATEGORY: Time Factor

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Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Fisher, et al. 1978 BTES contd					3. High amoung time provided for performance of skills tasks where there is high level of success. (process-product correlation)	High					
					And						
					4. Low success relates to ---	Low					
					5. Amount of allocated and engaged time			NR			
					And						
					Provision of high success rates			somewhat higher			
					Optimum behavior: 6. High diagnostic accuracy	High				High Student engagement	
					Optimum: 7. High level of matching instruction with needs and skill levels of students	generally high					
					Optimum: 8. High amount of time given to substantive interaction (See Rosenshire, 1980-BTES-on substantive interaction)					High student engagement	
					Optimum: 9. High amount of time given to academic feedback (process-product correlation)	High				High student engagement	

CATEGORY: Time Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Fisher, et al., 1978 BTES contd					Optimum: 10. High amount of providing direction and discussing structure of lesson	High success rate					
					Not Optimum behavior: 11. High amount of explanations given to expressed student-need	fewer high success tasks and more low success tasks					
					Not Optimum behavior: 12. High amount of reprimands	low				Off task behavior task difficulty-high	
					Optimum behavior: 13. High academic goals - emphasis on the importance of school learning	high					
					Not Optimum for student achievement: High orientation toward affective outcomes	low				Less allocated time for skills instruction Lower engagement rates Lower success tasks	

CATEGORY: Time Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Fisher, et al., 1978 BTES contd					Optimum behavior: 14. High provision of learning environment characterized by student responsibility for academic work and by cooperation (with other students) on academic tasks.	high					
Evertson, Emmer & Brophy, 1980	7/8th	mixed rac & eth back grou	mixed	math	Characteristics of effective teachers: 1. at least half of each period -lecture, demo, & discussion. 2. Less than half period - seatwork. 3. Less transition and group disciplin time than in classes with less effective teachers. 4. More time spent on basic concepts than in classes of less effective teachers. 5. Did not presume on high level of prior knowledge among students. 6. Enforced rules - low anxiety high confidence, high task orientation, high enthusiasm					Observers scored teachers on classroom observation scales and rating scales effective teachers were significantly high.	

CATEGORY: Time Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Troisi, 1983 review of research				Math	Characteristics of effective teachers: Direct instruction - more than in English classes						
				Math & English	Use their knowledge of students' skill level						
					Try to create a learning environment that is most effective for each student.						
Soar, 1973	1-3	low			Characteristics of effective teachers: More time for task-related or academic activities						
	1-2	low		Math & reading	Structured time on low and high complexity tasks	gains					
Stallings & Kaskowitz, 1974	(elem)	low			Effective teachers: Low time spent discussing matters unrelated to content of lesson	gains					
	1	low		Reading	High total academic verbal interactions	gains in low-complexity performance					
	1	low		Math	High total academic verbal interactions	gains in low- and high-complexity performance					

CATEGORY: Time Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Centra & Potter 1980 reviews on model for investigating school & teacher variables which influence student achievement				Reading & Math	Increased time in school Increased time for other activities (art, etc)	higher achieve. lower achieve.					
Stallings, 1976	1-3			Reading & Math	Increased school day	higher					
Rieth, Polsgrove & Semmel, 1981 research review					Higher correlation between engaged time and student achievement than between allocated time and achievement					Student engagement depends on how allocated time is used.	
			Regular and Spec. Education		Direct instruction Advice for minimizing transition time: -present instructions clearly -instructing groups away from rest of class -preparing materials before beginning of class	maximizes ALT					

CATEGORY: Time Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Gambrell, Wilson, & Gantt, 1981	4th Boys	mixed	"good" & "poor"	reading	Students working with teacher					On Task: good rdrs: 92% of the time poor rdrs: 83% of the time	no diff. for on task behavior ↓ does not support finding of Soar, 1973; Stallings & Kaskowitz, 1975 That s. are more on task when with teacher
					Students working independently					good rdrs: 89% of the time poor rdrs: 83% of the time good rdrs more on task during instruc. time than poor rdrs.	
otnik, 1982	jr-sr high	mixed		8 major areas	Provision of appropriate materials and content					relates positively to the amount of time students work alone	
	jr. high				large classes, late classes, and younger students					Teachers spend more time on students behavior	
	jr. high				upper curriculum track					teachers spend less time on students behavior	
					classes with more females					teachers devote more time to instruction	

CATEGORY: Time Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Frommer, Evertson & Anderson, 1980	3rd				Effective classroom management: [more time explaining and reminding students of the rules]					all activities: on task (86%) more than in classes of less effective managers (75%) Content activities on task (65%) more than in classes of less effective managers (59%)	
Ponder & Hinely 1982	6-12	mixed racially		Ind. Arts	Effective Classroom management: "down time" kept to a minimum very little classtime is spent with an individual student, esp. at the beginning of the period high mobility during the period monitoring of potential trouble spots with rapid, low threat int. when trouble arises						

CATEGORY: Time Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Chow, Thomas, Thum, Body, & Phillips, 1981	5th-6th Regular & Mainstreamed	ethnic bdgd mixed		math	Opportunity to learn:						
					Designated time in academic area (i.e. math)					67% opportunity to learn out of designated time 33% of time on non-academic activities	
					Provision for engaged time					mainstreamed: 1/3 the amt. of high success time as regular students	
					Provision for high success					younger & female students had more high-success time than older & male mainstreamed students- not paralleled with regular sample	
					as class size increased, more time was spent on classroom management than on academic activities- But class size did not relate to student engagement or time on success tasks						
					Number of LD in class-no relationship						
					Direction instruction					no affect on success on tasks	

CATEGORY: Time Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Wyne & Stuck, 1982 Review of time-and-learning research					A primary characteristic of effective instruction is teacher behavior that leads to high time on task Implications of time-and-learning research should be viewed in 2 categories: -opportunity to learn -quality of instruction (They list 11 specific implications)						Problems w/most time-and-learning research: -most is correlational or descriptive -time is not uniformly defined -very small # of controlled studies

CATEGORY: Instructional Approaches

Reference	Context Variables Grade	SES	Achieve. Level	Subj.	Teacher Behaviors	Outcome/Results Achievement ST	 LT	 Affect School	 Self	 Other	Relationship with other research
Doyle, 1977	secondary [multidimensionality of classroom interactions]	all			**5 Basic Techniques:** 1. Chunking events into larger units 2. Differentiation- discriminating the significance of events 3. Overlapping- handling 2 or more events at once 4. Timing- monitoring or controlling duration of events 5. Rapid-Judgment					High level of work involvement and low disruption	
Brophy, 1982	[Despite differences of student backgrounds and abilities]				High expectations for students' -achievement -behavior Acceptance of responsibility for students' growth High amount of planning Business-like and task-oriented classroom structure					Teachers viewed as "successful"	
Emmer et al., 1981 ED 226 451 ED 226 452 (2 studies)	one- jr. high	mixed		English Math	**Management Techniques:** -clear & realistic expectations centered on routines -establishing rules at beginning of year -reinforcement of rules -high level of planning -teacher in charge at all times -content focus & accountability system - soliciting personal info. begin of year					High levels of task engagement and appropriate behavior Low levels of disruptive or inappropriate beh.	

CATEGORY: Instructional Approaches

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Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Guthrie, 1982					**Good Management:** -long-term solution-oriented planning -clear communication of rules which were taught at beginning of year -consistent reinforcement of rules -problems are prevented -behavior is monitored -inappropriate behavior is stopped before it is seriously disruptive						similar to outcomes of Emmer et al. (1981)
Emans, 1983				Basic math and reading skills	**Direct instruction** characterized by active teaching. -teacher sets clear-goals and involves all students -sufficient and continuous time allocated to learning -material is covered in small steps at rapid pace -questioning at low cognitive level -teacher monitors students & provides immediate feedback -atmosphere is structured but not authoritarian						

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Rosenshine, 1983 Review of studies Note: See outcome; other	elem. jr. high sr. high				Direct Instruction in 6 Instructional Functions: 1. Review of previous material 2. Demonstration of new content and skills 3. Guided practice and checking for understanding 4. Feedback and corrections with reteaching if necessary 5. Independent practice 6. Periodic review at regular intervals					Teachers implemented pattern of direct instruction "successfully" Teachers have some difficulty in phase of direct instruction which requires concept development by students -Roehler & Duffy, 1981 -Good & Grouws, 1979	
Souster, 1982 ED 222-468	6th	Low		Language Math Reading	Indirect Teaching		+Lang.				Does not support findings of high basic skills achievement with direct instruction and lower achievement with ind. instruction
		Mixed		Language Math Reading	Indirect Teaching and Combination of Direct and Indirect styles- Note: "Indirect" and "direct" were not defined		+lang. +math +reading				

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
						Achievement		Affect		Other	
	Grade	SES	Achieve. Level	Subj.		ST	LT	School	Self		
Peterson, P.L., 1979 Review of studies comparing open and traditional teaching styles	elem. jr. high				Traditional styles (direct instruction) compared to open teaching styles	slightly higher achievement, but lower on tests of more abstract thinking, such as creativity and prob. solving.				see Achievement	Her review includes comparison with Horowitz's review & offers criticism of his methodology
					"Open Teaching" compared to traditional style	lower on achievement tests, but higher on creativity and problem solving				see Achievement	
Medley, D.M., & Crook, P.R. Late: 1980					Important Teacher Tasks: 1. maintaining students' task-involvement 2. large group, teacher-student recitation about lesson content 3. minimizing disruptive pupil behavior 4. managing small group activity (difficult to do well, so teachers observed as "effective" usually are not observed conducting small groups) 5. supervising pupil seatwork 6. structuring a large portion of pupil time	high amount of learning					

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Armento, B., 1977	3,4,5			social science	Effective Teachers Demonstrated: 1. Accuracy of concept examples 2. Relevance of behavior to objective 3. Balance between concrete and abstract terminology 4. Reviews and summarizes main ideas 5. Expresses interest and enthusiasm over lesson content	(post test was immediately afterward) + + + + +					
Anderson, L.W., Scott, C.C., 1978 They equate high students involvement with high teacher effectiveness	high school (9-12)	"suburban" H.S."	2 Subsamples APT-scholastic aptitude ASC-academic self-concept	humanities & social science	(Study of Student involvement in learning)	Involvement=on-task Behavior		Summary: The group whose task involvement was most affected by the teaching method was the low APT-low ASC group They were most involved through classroom discourse and seatwork. High APT, high ASC also responded differently to different methods and were most off-task in group work setting. Different students benefit differently in different situations. Implication: Classroom discourse method appears to be most useful method in heterogeneously grouped classes.			
			1. High Apt. High ASC		Audio-visual presentation lecture classroom discourse seatwork groupwork	highest H H H Low					
			high Apr low ASC								
			2. med apr high ASC		audio-visual lecture classroom discourse seatwork groupwork.	higher H H same H Low					
			med apr low ASC								
			low apr high ASQ								
			3. low apt. low ASC		classroom discourse seatwork lecture audio-visual seatwork	highest high low low low					

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Farnsworth, B.J., Daines, D., 1978	3			writing	Indep. variable: Cognitive level of teacher's instruction					Writing performance the higher the teacher's cog. level of instruction the higher the level of students' performance.	Not to be viewed in contradiction of basic skills research which recommends lower cognitive level teaching at this grade.
Brophy, 1975 Texas Teacher Effectiveness Study	2-3				Effective Teachers						
		low			more structure and were more restrictive than teachers of high SES students	high gains on standardized tests					
		low			high expectations communicated through warmth, supportiveness, patience, and encouragement						
		high			form of structure provided more opportunities for students to work independently						
		high			high expectations were communicated through challenge and critical demandingness						
		low			important for teachers to make sure children got assignments they could handle and to make sure assignments were completed						
		high			environment needs to be stimulating and interesting						
		---			teacher enthusiasm & verbal preparation with students not important with young children						
		---			indirect teaching inappropriate in early elem grades						

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
						Achievement		Affect		Other	
	Grade	SES	Achieve. Level	Subj.		ST	LT	School	Self		
Evertson, 1980	jr. high		low	math	Lecture phase of lesson in preparation of seatwork included brief, highly-focused seatwork activities. Long, extended seatwork activities were avoided. Teacher closely monitored seatwork. Immediate feedback for seatwork. Whole class presentation.					high task involvement low disruptive behavior	
Evertson, Sanford & Brophy, 1980	jr. high			math	high percentage of time teaching whole class		+				
					Almost all class discussion involved whole class.		+				
					High percentage teaching subgroups		-	-(teacher)			
					Preference for lecturing		-	-(")			
					High expectations			+{for high level (teacher)			
					Teacher preferred fairly structured classroom environment & accepts personal responsibility for management & discipline		+	-{for low level(") + (teacher)			
					Teachers believed that they can do little about discipline problems			- (")			
					Teachers were reluctant to rely on text		-	- low level (teacher)			
					Frequent homework			+ (teacher)			
					Teachers assumed that students would enjoy lessons without special dressing		+				

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
						Achievement		Affect		Other	
	Grade	SES	Achieve. Level	Subj.		ST	LT	School	Self		
Evertson, Sanford & Brophy, 1980 (continued)	Jr. high			English	Teachers preferred formal, more traditional classroom environment		+				
					Teachers demanded attention to directions. Students took responsibility for work.		+				
					Teachers used text, peer tutoring, reading aloud slowly, reviewing directions carefully and slowly.		-high ability -low ability				
					Drill and boardwork- new material & checking comprehension tests		+high ability -low ability				
					High % grades based on objective evidence			+high ability -low ability			
Good & Grouws, 1979 J. of Ed. Psych.	4th	low urban		math	Key Instructional Behaviors: 1. Daily review 2. Concept development 3. Seatwork with monitoring and feedback 4. Homework assignment 5. Special reviews -weekly (each Monday) -monthly (every 4th Monday)		+				

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Emmer, Evertson, & Anderson, & Brophy, 1980	3	low middle			Effective Classroom management, with beginning of the year behaviors rated high as predictors of later behavior and organization: Effective managers had: 1. workable system of rules and procedures which they taught their students in first weeks. 2. careful monitoring of students with careful directions 3. Control over inappropriate beh. stopping it sooner than less effective managers 4. predictability and credibility among students because consequences of appropriate and inappropriate behavior were clear and consistent	"Associated with student learning" -Good & Grouws 1979				high student engagement time	
Brophy, 1983					Success Rate & Instruction: Desired for effectiveness Teachers who monitor responses and provide feedback Students working alone or doing seatwork and homework					Desired for effectiveness: 70-80% success rate 95-100% success rate	

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	grade	SES	Achieve. Level	Subj.		Achievement ST	Achievement LT	Affect School	Affect Self	Other	
Slavin, 1980 Rev. of research					Cooperative Learning in Teams -effective for increasing achievement varies with approaches -some evidence suggests: Group-Mastery methods						
				Knowledge calculation reading appl. of skills		more effective for low-level learning outcomes					
				identifying concepts analyzing problems making judg. and eval.	Group-Investigation methods	more effective for higher order skills					

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Peterson, P.L., 1977 ATI study	9	ethnically mixed 1/2 blue collar		soc. sci.	Structuring and participation structuring: goals verbal markers transition signals advance organizers summaries (by tchr/by students) reviews (by tchr/by students) previews participation: questions-tchr & students redirections use of student ideas students remarks	(ATIs were more significant in ST than LT) Mult.Ch. and Essay-similar results					
		Anxiety-Ability	high anxious-high ability			worst in low struc/low part. equally well in other 3 treatments				Student Attitude: consistent trend indicating instruc. treatments with high achievement outcomes correlate with low student attitude toward treatment and vice versa.	
			high anxious low ability			best in low struc/low part. worst in high struc/low part.					
			low anxious high ability			best in low struc/low part. worst in low struc/high part.					
			low anxious low ability			best in high struc/low part. worst in low struc/low part.					

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Peterson, 1977 continued			Independence-Conformity: independent students		Instruction allowing students to choose their own achievement strategy, e.g., low struc/low par. or high struc/high par. classes	highest					
			conforming students		Instruction providing clear strategy to which students could conform, e.g. high struc/low par.	highest					
			conforming students low on total motivation		Instruction providing the one clear strategy as conformance to teacher structure.	highest					
			independent students high on total motivation		Instruction providing low struc/low par. Instruction providing high struc/ low par.	highest lowest	but differ. was small				

CATEGORY: Instructional Approaches

Reference	Context Variables: Grade	SES	Achieve. Level	Subj.	Teacher Behaviors	Outcome/Results: Achievement ST	Achievement LT	Affect School	Affect Self	Other	Relationship with other research
Peterson & Jamick 1979 &1981 (same study)	4-6			math	Learning in Large-Group and Small-Group Approaches: (In small grps. higher abil. students helped lower abil. students)					Attitude tow. math	Contradiction of Rosenshine's 1979 findings saying that large group instruction is more effective
			high ability		small group instruction comp. to large group		higher			higher	
			low ability		large group instruction comp. to small group		higher			higher	
			students who preferred small grps.		small grps. comp. to large grps.		lower				
			students who preferred large grp.		large grp. comp. to small grps.		lower				

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Webb, 1980	11			math	Achievement in Group Work 3 Phases: 1. Teacher gave instruction for math skills 2. Students worked in groups to solve math problesm. They had to put together the component skills taught to everyone by the teacher They were encouraged to ask ques. of teammates and to explain to one another. (controls were not placed in grps.) 3. Testing (individual)						
			high			high performance related to explaining to low students					Further research is needed to examine relationships between ability and personality variables.
			middle			success related to conferring with same level students					
			low			high performance related to receiving explanations from high students					

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Webb, 1982	7-8		above ave. classes	math	Achievement in Group Work 3 Phases 1. Tchr gave instruction for math skills 2. Group work (see Webb, 1980 p.14) 3. Indiv. testing						

CATEGORY: Instructional Approaches

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Roehler & Duffy, 1981					Effective Teaching in Elem.: Too often effective teaching is seen as effective classroom management -use of direct instruction -high time on task with teachers looking like tech. What is needed in Tchr. ed.: 1. Illumination of the complexity of classroom life 2. Approaches to help tchrs explicate w/clarity and provide prompts to assist students' learning 3. Help tchrs use instructional material in ways that help students learn.						

CATEGORY: Planning

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Trahan, 1979					Planning is "the foundation upon which all effective instruction is based:						
Virginia State Dept. of Ed.					Effect. Tchr. plan a "controlled learning environment: Planning should be in 4 parts: 1. what the students should learn 2. how instruction is to be delivered 3. when and how the different learning activities will be conducted 4. the time-line and grouping arrangement for instruction					more time-on-task w/ higher achieved.	
Shavelson & Borko 1979					The timing of questions may be more important than the frequency of asking.						
Clark & Yinger, 1979 (3 studies)	elem urban rural and suburban				Survey of Elem. Teachers Findings: 1. Learning objectives are usually not the starting point of planning usually planning is around students activities 2. They tend to limit their search for ideas to resource that are immed. available, e.g., manuals films, magazines						

CATEGORY: Planning

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Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Clark & Yinger, 1979 continued	1. continued				3. most planning is for rdg & lang arts- then math, social studies, and science 4. teacher planning is more explicit and involves lorger lead times in team teaching than in self-contained 5. most common form of planning was outline or list, but some reported that all plans were in memory 6. plans seemed to provide teachers w/ psychological benefits (e.g. security) not just as a means of organizing instruction						
	2. upper elem				Laboratory Study of Teacher Judgment in Planning process tracing suggests 4-step process 1. attempt to understand the activity 2. imagining use of activity 3. thinking of ways to modify or adapt to avoid problems 4. creating mental image of revised version of the activity						

CATEGORY: Planning

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Clark & Yinger 1979 continued	3				Field Study of Teacher Planning and plan implementation (This was a longitudinal case history of a plan) what they found in this approach fit well with findings of Lab. study 2 Kinds of Planners: 1. incremental planners -brief prob-finding stages -brief unit plans -short planning steps using day-to-day info. 2. comprehensive planners -well-defined framework for future action -specify plans before teaching -plan by units						
Clark, 1983					Teachers who are profilic planners -not prolific planners			lower attitude higher attitude			

CATEGORY: Planning

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Shavelson & Borko, 1979 Review of research & presentation of model					Several factors affect teachers decisions about planning: -students characteristics -teachers educational beliefs and cognitive styles -nature of instructional task Factors which should be considered in planning process -students' achievement -their class participation and work habits -amount of cooperation between students in class -problematic classroom behaviors						
Bowermaster, 1981 review of research					Planning characteristics for more effective teachers; they: 1. plan ahead 2. formulate rules and procedures early in year and give clear explanations to students 3. have established procedures relating to instruction 4. plan for unusual situations 5. have plann for acquiring materials 6. have planned their room arrangements 7. plan early morning activities to include ones which are easy to focus one's attention and to participate in						

CATEGORY: Planning

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Griffin, 1983					Studies of planning and decision-making are few Research in the area has methodological problems A need for research linking teacher decisions to student learning						

CATEGORY: Knowledge and Training

page 1

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Pavalko. 1970					Studied recruitment, selection, & retention of teachers: After 3 years- 73%- lowest ability undergrad. remained 56.7%- middle ability undergrad. remained 59.3%- highest ability undergrad. remained						
Schlechty & Vance, 1983					no evidence that people w/graduate degrees are more proficient teachers						confirmed by Harrison, 1976
					schools which engage teachers in job-related discussions and share in decision-making re instructional programs					these schools are more effective than schools which do not include teachers in decision-making.	

CATEGORY: Knowledge and Training

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Brophy, 1976	K-3				Teachers should have specific training for their use in lower grades where basic skills are stressed						
Brophy, 1979					To improve effectiveness, teachers need to: become more proactive in their planning engage in peer observations and conferencing						
Joyce, 1978					Effective teaching requires: a variety of methods training to help teachers learn different approaches- & when to use them						
Joyce, 1982					Coaching by peers enables teachers to transfer new teaching models to their active repetoire.						

CATEGORY: Knowledge and Training

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Thompson, 1980					Teachers philisophical beliefs are an inportant aspect of their decision-making re teaching methods- Recommend more attn. to ed. phil. in ed. training Teachers make decisions about methods based on concern for basic skills, so basic skills issues should be included in training of new methods.						
Miller, & Ellsworth, 1983					Inservice: Combination of the following categories are the groups teachers fall in subsequent to training: 1. teacher knowledge 2. teacher attitudes 3. application of teaching tech. So there are 8 distinct subgroups, showing that when uniform content is presented, it is assimilated and implemented at different levels by different teachers.						

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Harrison, 1976	primary			reading	Effectiveness of teacher related positively to : teachers' autonomous attitude " preference for pragmatic activities they tend toward abstract conceptual development they have on the average 3 children of their own they lecture 1/4 less than other teachers whose gain was less than a year. Teacher's conceptual level was not found to be primary contribution of student achievement.	gain of at least one year					
Diorio, 1982					Curriculum theory "knowledge and autonomy are inversely proportional with respect to practice." (e.g., carpenters are very closely governed by their relevant knowledge; citizenship is an example of the other extreme.					Amount of knowledge does not provide clear guidence to practice in teaching- no clear body of knowledge is found	

CATEGORY: Affective Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
						Achievement		Affect		Other	
	grade	SES	Achieve. Level	Subj.		ST	LT	School	Self		
Brophy & Evertson 1974					Teacher praise of good academic work by the student during teacher- initiated interactions during student- initiated interactions	positive correlation negative correlation					
Brophy, 1979					Praise- The direction and intensity of the relation of praise to student learning vary with context Praise may be better characterized as an outcome of other classroom events that cause student learning than as a cause of such learning.						

CATEGORY: Affective Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Anderson & Anderson, 1982					Five principles of affective assessment: 1. know why you're assessing 2. know what you're assessing 3. know what instruments are available- (they list 5) 4. know how good the instruments are 5. know how to interpret the scores						
Emmer, Sanford, Clements, & Martin, 1981	jr. high			English	Implementation of a program of effective classroom management techniques			positive correlation			
Evertson, Sandford & Brophy, 1980	jr. high			English	Some form of individualization or ability grouping					attitude toward teachers- high correlation	

CATEGORY: Affective Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Evertson, Sanford & Brophy, 1980 continued	jr. high			math	Teachers using high percentage of subgroups, preferring lecturing, and who believed they could do little about discipline problems.					attitude toward teachers- negative correlation	
				math	Teachers who gave frequent homework					attitude toward teachers positive correlation	
			high ability	math	Teachers who held high expectations for their classes					attitude toward teachers positive correlation	
			low ability	math						attitude toward teachers negative correlation	
Newberg & Loue, 1982		low		reading	Affective Education Program in Philadelphia Teachers were trained to: communicate high expectations of achievement specific & timely w/feedback develop sense of shared responsibilities w/students for teaching & lessons	indications of higher achievement - various tests IRI phonics SSR- time comprehension					

CATEGORY: Affective Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Beane, 1982					Activities to enhance self-perceptions, e.g.: teacher-pupil planning cooperative learning peer tutoring multi-age interaction self- evaluation out- of- school activities community service projects	improved				Important to improve self-perceptions as an end to itself	
Combs, 1982					The importance of affective ed.: "Learning w/out affect is unlikely to influence behavior and an educational system that rules out feeling or emotion guarantees ineffectiveness" 4 Affective Factors which influence learning: 1. self-concept 2. challenge or threat- best to have c. w/out t. 3. values 4. belonging and being cared for						

CATEGORY: Affective Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
						Achievement		Affect		Other	
	Grade	SES	Achieve. Level	Subj.		ST	LT	School	Self		
Brookover, Scheitzer, Schneider, Beady, Flood, & Wisenbaker, 1978					Teacher expectations of student performance (Michigan schools)					differentiated effective classes from ineffective classes	
			low achievers		teacher interaction					less motivating and supportive than with high achievers	
Kernan, 1979 TESA	all		perceived as high achievers		provide more opportunity to respond	gains				less absenteeism & discipline referrals	
					teachers trained to practice equality of interactions					more engaged in learning procedures than students not perceived as high achievers	
Farley, 1982 TESA	all				teachers can be trained to hold higher expectations of all students & to practice equality of expectations, interactions and learning opportunities						
					training gave TESA teachers specific, concrete, observable behaviors that they could see, practice, and use in their classrooms	significant gains		improved attitudes			

CATEGORY: Affective Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Brophy, 1975	2-3	high	high ability		positive teacher affect e.g., warmth and encouragement	negative correlation					
		low	low ability			positive correlation					
					negative teacher affect (among generally caring teachers)	no significant correlation					
Soar & Soar, 1978	1&5				positive teacher and pupil affect	strongly and consistently negative					
Lambeth, 1981	academic & technical high school students				Five categories of teacher behavior: caring respect interpersonal contact course organization learning environment	Best predictor of achievement: teacher caring caring plus course org. teacher respect was also highly correlated with caring					

CATEGORY: Affective Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Morine- Dershimer, 1982	2-4	low multi-ethnic			Teacher's praise, as viewed by students: 1. as deserved for a correct or good idea 2. as an instructional function 3. as a routine interactive function such as response to gain class attn., to encourage a students' or the class as a whole 4. as no codeable function					high participation viewed praise as #1 Low participation viewed praise as #2 and saw that teacher praise helped identify correct answers for them (audience)	
Brophy, 1981 * Review of research					Praise should be spontaneous, sincere, specific, & informative (In study after study measures of teacher praise failed to correlate with other classroom variables, that would be expected if it were reinforcing.)					Students response: some who were previously performing for intrinsic value of learning may perform for praise and be less motivated Some are embarrassed by praise, others view praise as insincere and view it as an attempt at encouragement because they are in fact not doing well.	
Good & Grouws, 1979	elem.			math	Effective Teacher: offers little praise or criticism basically non-evaluative						

CATEGORY: Affective Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Emans, 1983 Review of research				Reading	On praise and criticism	may have negative effect					
Crabtree, 1982	7-8		regular ed, special ed, tutoring (1 or 2)		Praise and Criticism: no significant difference between large calss, small class, reg. ed. spec. ed., tutoring and ratios of praise and criticism most teachers used more praise than criticism not systmeatic but in reaction to student behavior praise equal for boys and girls more criticism toward boys more criticism than praise to groups						

CATEGORY: Affective Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Beane, Lipka, & Ludwig, 1980 Review of research					Teachers can build self-esteem in ways other than praise: students need feeling of academic success challenging atmosphere in which students are successful and do not feel threatened climate: respect, fairness, self-discipline, & democratic process use of techniques which minimize failure & maximize success, e.g. team learning self-evaluation						
Gresham, F., 1982 Review of Lit.					Faculty Assumptions: Re- Was handicapped students placed in regular classes will have increased social interaction and acceptance with/by regular students and that handicapped students will reflect the social skills of an earlier student					Handicapped kids not trained w/soc. skills generally are not liked, accepted & chosen as friends by non-handicapped students. They interact at low levels and do not imitate behavior of nonhandicapped unless specific programming has been provided.	

CATEGORY: Diagnostic- Prescriptive Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Hunter, 1979					Teachers' descisions and behaviors must be the outcomes of diagnostic information 3 Forms of diagnosis: formal informal inferential (based on experience) 3 Areas of diagnosis: difficulty of content learning style- recommends helping children learn thru all modalities use of principles of learning 4 Categories of teaching decisions and actions: those that increase the probability of students' intent to learn (motivation) those that increase the rate and the amount of learning those that enhance retention those that encourage the transfer of learning to new situations that require problem-solving, decision-making, and creativity.						

CATEGORY: Diagnostic- Prescriptive Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Peterson, L.T., & McBrayer, J., 1976					Purpose of diagnostic prescriptive teaching is to change emphasis from group-centered teaching to individualization Recommends team teaching: Diagnostic Teacher Teacher Intern (i.e. assistant teacher) to help teacher meet individual needs of students.						
Cheek & Cheek				Reading	Reading program should include the following components: 1. scope and sequence grade skills 2. procedures to facilitate continuous diagnosis of each student 3. a variety of materials and teaching techniques for prescriptive instruction 4. the use of guided or directed reading lesson procedures 5. methods for keeping records on each student						

CATEGORY: Diagnostic- Prescriptive Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Brophy & Evertson, 1974	2nd-3rd				Assigning work that was too easy or too difficult	negative correlation					
					Assigning no inappropriate (level) activities	positive correlation					
		high			easy assignments	low learning gains					
		low			too difficult assignments	low learning gains					
Brophy, 1983					Importance of high success rate:					Recommends:	
					Teacher present to monitor and give feedback (material which is new and provides a challenge should have teacher present)					70-80% success	
					Students working independently applying skills already mastered or practicing to ensure retention					95-100%	
Evertson, Sanford, Brophy, 1980	jr. high			math	Observed to be most effective: frequent use of self-made and standardized assessment instruments for diagnosis and evaluation						

CATEGORY: Diagnostic- Prescriptive Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Fitzmaurice, 1976	4-6				Inservice training in diagnostic-prescriptive approach						This type of research is criticized because of lack of control over control group variables- in this case exp. teachers were trained while control teachers weren't.
				Spelling		higher than in control group					
				Reading		may be higher than in control group					
Fesler, Guidubaldi, & Kehle, 1976	K-3	urban, mostly black, some neighborhood			PEP-IPI Primary Education Project-Individually Prescribed Instruction emphasis on maturational processes and learning beyond these processes (Piaget; Gagne) PEP Focuses on: perceptual & motor abilities language concepts classifying skills reasoning abilities IPI focuses on definite skills in: reading math Teacher & Parent involvement	higher than control group				reduced transfer requests from teachers teachers for project parent approval and change -increased attendance at school-comm. functions -successful organization of Follow through parent groups	

CATEGORY: Diagnostic- Prescriptive Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Saunders- Harris & Yearly, 1981	7	mixed		science	Diagnostic- Prescriptive Teaching	not significant	significant positive	positive toward use of objectives, diagnosis & remediation		Also, on locus of control: internal students scored higher than external students.	
Arter & Jenkins, 1979					Review of research & challenge to belief that differential diagnosis prescriptive teaching is valid and justifiable. article describes DD-PT as- diag. info. is used to generate a program to directly remediate an underlying ability weakness. To the child activities in the areas of weakness are prescribed. DD-PT predominant model in Spec. Ed.	They say children do not appear to benefit					Ewing & Breht, 1977 Research has not validated diagnostic prescriptive models. Programs using D-P models should be viewed cautiously & carefully monitored

CATEGORY: Diagnostic- Prescriptive Factors

Reference	Context Variables				Teacher Behaviors	Outcome/Results					Relationship with other research
	Grade	SES	Achieve. Level	Subj.		Achievement		Affect		Other	
						ST	LT	School	Self		
Heckler & Youngberg, 1975					IMPACT- diag.-prescriptive teaching kit for regular teachers with mainstreamed LD and ED students Includes materials for: assessing academic skills, beh. needs, & learning processes suggestions for prescriptions based on assessment					Improved self-concept & attitudes toward learning	
Whyte, 1980	6-14 yrs. old	rural Canada	learning & behavioral disorders		Use of the prescriptive or diagnostic teaching model: more research is needed use of the model is usually overly simplistic & of doubtful nature	Greater gains in intellectual development than control group Greater gains in reading & math, language skills, & social development than control group				Individual Profiles- relatively higher gains by: EMR and "slow learners" visual-motor responded better than those with auditory problems all the hyperactive children decreased level of activity & made learning gains Numerous children were able to return to regular classes	

Appendix M

Training Options
Coding Manual

Training Options Coding Manual

The SNAP training options data base contains numerous types of learning experiences for classroom teachers of mainstreamed special education students. Included in the data base are: workshops; modules; chapters in special education textbooks; personal accounts of handicapped people in books and films and in teachers' meetings with handicapped individuals or their families; procedures for classroom observation with and without peer participation; specific teaching strategies; procedures for collaboration with other educators; recommendations for action research.

Each training option is described in the data base in such a way that the SNAP expert system can select individually appropriate training for each teacher using the system. The following is a list of the fields used for describing each training option:

Name
Short Name
Stage of Concern
Goals
Goal Specificity, Goal "d"
Goal Specificity, Goal "1"
Academic Learning Time Problems
Questioning Problems
Direct Instruction Problems
Affective Mode

Teaching Level

Teaching Area

Situational Requirement

Prerequisite

Shape

Description

Content

Coding of Fields. An explanation of each of these fields, plus codes used to describe training options, follows:

Name - title or name of training option.

Short Name - shortened version of title or name of training option.

Stage of Concern - level or levels of personal concern regarding mainstreaming, as determined by SNAP adaptation of Gene Hall's Stages of Concern instrument. The six subscales used in the SNAP adaptation and addressed to the respondent are:

Informational - You have a general knowledge of mainstreaming, but you are interested in learning more about it, particularly about general characteristics, effects, and requirements.

Personal - You are uncertain about the demands of mainstreaming, the effect it may have on your role in relation to the reward system, decision-making, and potential conflicts with your own personal commitments.

Management - You are concerned with the procedures and tasks involved with mainstreaming, and with issues related to efficiency, organization, scheduling, and demands on your time.

Consequences - You are concerned with the impact of mainstreaming on all the students you deal with daily, both those who are handicapped, and those who are not.

Collaboration - Your focus is on coordinating and cooperating with other teachers and staff members to optimize the effects of mainstreaming.

Refocusing - Your focus in on exploring ways to improve mainstreaming, including the possibility of changing the way it is accomplished, in order to maximize its benefits to all students.

A training option is coded for one or more stages for which it would be appropriate as training. The field is called SOC.

Codes are: in - informational
pr - personal
mn - management
cq - consequences
cl - collaboration
rf - refocusing

Goals - Training options are coded for goals so that they correspond to the learning goals that teachers have selected. A training option may be coded for one or more goals, or it may be given a code of "none" if the purpose of the training is not clearly associated with one or more learning goals.

Codes are:

I would like to learn more about. . .

a - special education procedures in my school.

b - special education services that are available in general.

c - approaches to working with special education students.

d - the types and characteristics of students served in special education.

e - the learning problems that students can have in school.

f - how to obtain instructional help in my classroom from special educators.

g - how to use classroom aides.

h - how to gain access to instructional materials, equipment, etc. for mainstreamed students.

i - how to obtain additional information about mainstreamed students in my class.

j - how to work with other educators on tasks related to mainstreaming.

k - how to select and adapt materials to teach students who have trouble learning.

l - how to teach students who are having trouble learning.

m - how to encourage desirable social interactions between special education and non-special education students.

n - how to provide instruction for slower students without disrupting instruction for other students.

o - how to analyze student learning problems to determine how to deal with them.

p - how to deal with the issue of grading students fairly when they vary widely in ability.

q - how to keep better track of how students are doing in my class.

r - how to determine students' skill level in relation to what I teach.

s - (This goal has been deleted.)

t - how to interpret assessment results in a student's records.

u - the behavioral and motivational problems that students can have in school.

v - how to identify students with behavioral or motivational problems.

w - how to deal with students' behavioral or motivational problems.

x - how to confer with parents.

none

Goal Specificity, Goal "d" - Goal "d" states: "I would like to learn more about the types and characteristcs of students served in special education." Training options are coded to indicate specific handicapping conditions to which the content pertains. The field is called DSPEC.

Codes are:
ld - learning disability
mr - mental retardation
ed - emotional disability
v - vision

h - hearing
spl - speech and language
oi - orthopedic handicap
ci - chronically ill
cf - cystic fibrosis
cp - cerebral palsey
ep - epilepsy
md - muscular dystrophy
sb - spina bifida
none - used when the training option is not specifically for a certain handicap(s)

Goal Specificity, Goal "1" - Goal "1" states: "I would to learn more about how to teach students who are having trouble learning." Training options are coded to reflect major categories covered by this goal. The field is called LSPEC.

Codes are: lsr - teaching strategy, reading
lsm - teaching strategy, math
lss - teaching strategy, science
lso - teaching strategy, social studies
lsl - teaching strategy, language arts
lsa - teaching strategy, art
lsp - teaching strategy, p.e.
lsh - teaching strategy, home ec.
lsi - teaching strategy, industrial arts, voc-ed
lsg - teaching strategy, general

lcm - classroom management techniques or principles

lai - activities for teachers to provide additional insight into teaching students who are having trouble learning

lms - information or assistance regarding mainstreaming in general

Academic Learning Time Problems - Training options are coded to mark training that is appropriate for assisting teachers in improving their Academic Learning Time (ALT). Specific codes mark training that should enhance total engaged time of students, students' success level, and allocated time. The field is called ALTPROB.

Codes are: et - Engaged Time
sl - Success Level
at - Allocated Time
info - used when the need is for the Academic Learning Time information packet
none

Questioning Problems - To indicate training which is useful for teachers whose questioning style or strategy is weak, training options are coded for the variables related to effective questioning. The field is called QUESPROB.

Codes are: or - Opportunity to Respond
sl - Success Level
rd - Response Distribution
info - used when the need is for the Questioning Skill information packet
none

Direct Instruction Problems - Training Options are coded to show their usefulness for improving teachers' direct instruction. The field is called DIRPROB.

Codes are: high - for someone whose DIR is too high
low - for someone whose DIR is too low
info - used when the need is for the Direct Instruction information packet
none

Affect Mode - Training options which have a predominantly affective purpose and which are recommended for teachers who will receive attitude adjustment training are coded as either active or passive. "Passive" indicates training which is experienced primarily through viewing or reading. "Active" indicates training which requires the teacher to become actively involved (e.g., a meeting with a colleague who has a positive attitude toward mainstreaming). Training which does not have predominantly an affective function is coded "none." The field is called AFFCTMODE.

Codes are: p - passive
a - active
n - none

Teaching Level - Training options are coded to reflect the level or levels for which they are appropriate. The field is called TLEV.

Codes are: el - elementary
jh - junior high/middle
sh - senior high
all

Teaching Area - Training options are coded to indicate the teaching area, or subject, of a teacher for which they are appropriate. The field is called TAREA.

Codes are: la - language arts (including English, reading, and spelling)
ma - mathematics
ss - social studies
sci - science
h - health
pe - physical education
mu - music
art

hec - home economics
ia - industrial arts
ve - vocational education
fl - foreign language
all

Situational Requirements - Training options which will be appropriate only if certain conditions are met are coded for specific situational requirements. The code system must expand with the growth of the training option data base. The field is called SITREQ.
For current training options, the codes are:

(s=school)
sap - administrative participation
stm - time in August or September for meeting
scb - self-contained special education classes in your building
sse - opportunity to observe special education teacher
scp - 10-15 teachers with common problem
shi - several teachers of hearing impaired students
spg - teaches primary grades
sig - teaches intermediate grades

(c=child)
cld - teacher has ld students

cvi - teacher has vision impaired students
chi - teacher has hearing impaired students
csl - teacher has speech and language impaired students

(e=equipment)
evo - video equipment and operator
ecp - computer available in school

(h=human resource)
hse - collaboration with special education teacher in the tutoring of a special needs student
hcc - colleague in classroom or videotaping
has - aide or special education teacher
hfa - colleague who has favorable attitude toward mainstreaming and teaches class(es) which is (are) similar to trainee's
het - identification and videotaping of expert mainstreaming teacher
hhc - access to a handicapped child
hhp - recommendation by special education teacher of parents who will meet with teachers

Prerequisite - Since some training options will be effective only if a teacher has had certain background experiences, training options are coded for personal prerequisites when necessary. The code system must expand with the growth of the training option data base. The field is called PREREQ.

For current training options, the codes are:

(r=research experience)

rcr - experience in conducting research

rrr - experience in reading research reports

rcd - experience in curriculum development

rwp - experience with word processing

Shape - An abbreviated explanation of the physical form of the training option is given, e.g., film, videotape, classroom observation, book, chapter(s) in a book, article in professional journal, conversation with a colleague. The code system must expand with the growth of the data base. The field is called SHAPE.
For current training options, the codes are:

activity

article

article&bklet (article & booklet)

artc&lesson (arjicle & lesson)

bk&hdout (book & handout)

book

booklt (booklet)

book&module

brochu (brochure)

brochu-wkshp (brochure and workshop)

catalg (catalog)

chaptr (chapter)

chapt & module

chaptr&appen (chapter & appendix)

chapt part (chapter part)

chat

chklst (checklist)

cl obs (class observation)

cl obs w/frm (class observation with form)

confer (conference)

conversation

film

film/disc qu (film & discussion questions)

filmst (filmstrip)

folders

handout

hndout&artcl (handout & article)

handbook

kit & hdout (kit & handout)

manual

meetng (meeting)

module

module&artcl (module & article)

monogr (monograph)

obs & report (observation & written report)

organiz (organizaton)

outline

pamphlet

research

slides

software

visit

vtape (videotape)

wkshop (workshop)

Description - Thorough description of the training option is provided with information necessary for locating it for training purposes. The Description includes the training option copyright date, if a date is available and a reasonable part of the description. The field is called DESCRIPT. In DBaseIII descriptions are stored as a memo field.

Content - The contents of training options are summarized in a DBaseIII memo field called CONTENT.

Certainty Factors. To facilitate appropriate selection of training, several of the fields discussed above are coded with certainty factors. (The fields that are coded with certainty factors are: Stages of Concern, Goals, Affect Mode, Affect Mode--Passive, Affect Mode--Active, Teaching Level, and Teaching Area.) The codes are:

A - Always
H - High
M - Moderate
N - Never

These codes influence the likelihood that a training option will be selected for a particular characteristic of a teacher being trained. For example, a Teaching Level of "el" means the training is for an elementary teacher. To key the training as highly appropriate for an elementary teacher but moderately appropriate for a junior high or middle school teacher and of low or no appropriateness for a senior high teacher, the traning for TLEV would be: TLEV=elHjhMshN.

The code of <A>, as a certainty factor, means that the training should ALWAYS be associated with a particular characteristic, e.g., TLEV=elA means that <u>only</u> an elementary teacher should receive the training. The code of <N>, as a certainty factor, means that the training should NEVER be associated with a particular characteristic, e.g., TLEV=shN means that the training should <u>never</u> be recommended to a senior high school teacher. The certainty factor <H> is an indication of high confidence in a code by the coder. The certainty factor <M> may be an indication of moderate confidence in a code by the coder.

<u>Coding Convention</u>. To facilitate readability of the coding system, the following rule is followed: All codes are in lower case, with the exception of certainty factors, which are only in upper case letters. Memo fields (Descriptions and Contents) are passages of text written in standard English. Fields must be coded with letters or letter combinations, not with numbers.

Appendix N

Technical Report #204

Expert Systems for Educational Decision Making

TECHNICAL REPORT #204

Expert Systems for Educational Decision Making

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August, 1986

Special Project: Microcomputer-Assisted Needs Assessment System for Teacher Training in Special Education

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Abstract

This paper reviews artificial intelligence expert systems that have been developed for educational decision making. These include systems for planning, decision support, training, and research. The expert systems included in this review meet three criteria that distinguish expert systems from other computer programs: the system produces recommendations comparable to human experts in that domain; the system has separable components for representing knowledge and for reasoning; and the reasoning process is traceable to the user. For each use of expert systems, examples of existing sytems are described, and potential benefits and problems are discussed. Finally, cautions to would-be expert sytem builders are presented.

Expert Systems for Educational Decision Making

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For education, expert system technology is finally "coming of age." Until the last few years, expert systems required computing hardware and computer science expertise that were both expensive and difficult for educators to obtain. Recently, however, microcomputer-based, affordable authoring tools for expert systems have become available, enabling subject matter experts, such as educators, to develop expert systems for use in their own domain. These advancements have encouraged the development of educational expert systems that have great potential benefit for a variety of educational applications. In this paper, several recently developed educational expert systems will be described. They exemplify only a few of the potential uses for this technological advance.

This discussion is limited to systems that meet three important criteria for expert systems:

o the system's recommendations are comparable to those offered by a human expert in that domain;

o the systems have separable components for representing knowledge and for reasoning with that knowledge; and

o the reasoning process is traceable; i.e., the system has the ability to explain its reasoning process to a user (Waterman, 1986).

Systems that do not meet these criteria are not being considered, since lack of these features would seriously limit their uses.

Four basic categories of expert system use will be described in this paper:

1. planning
2. decision support
3. training
4. research.

Each use will be explained and instantiated with an exisiting educational expert system.

Expert Systems for Planning

Examples

An expert sytem has great potential as a tool for educational planning. Given information about the current status of a student, or a program and a desired goal, an expert system could infer intermediate steps that should be achieved sequentially, and the amount of time or money required to reach the goal, or it could define strategies for achieving the goal. For example, a knowledge base consisting of production rules concerning desirable ratios of teachers to students under various conditions (grade, subject, physical size of a classroom, years of teacher experience, contractual obligations, etc.) and current information such as enrollment figures, number and experience of teachers currently on staff, etc., could be used to plan staffing of school buildings within large school systems, as well as to plan for hiring or staff reductions.

CAPER (Computer-Assisted Planning for Educational Resources) is an expert system that is intended to serve a planning function. It is being developed at the Institute for the Study of Exceptional Children and Youth at the University of Maryland . CAPER is an attempt to address the problem of over-referral for special education services in schools that have a large number of students identified as "at risk" by their teachers. The goal is to develop an expert system that will help in planning sound instructional programs for indivdual students during the referral, diagnosis, and instructional planning processes. The system will recommend the best instructional program for a student prior to his/her placement in special education. Using information about effective classroom interventions for students who are experiencing specific problems, the expert system will recommend feasible instructional options within the regular class setting. In addition, it will guide formal diagnostic procedures and consideration of special placements. Currently naturalistic research is being conducted to determine what processes would help to alleviate problems of over-referral and inappropriate recommendations for special education placement, and what classroom interventions would be most useful to include in the system.

Two other educational expert systems which would be useful for planning were developed by the Artifical Intelligence Research and Development Unit, Developmental Center for Handicapped Persons, Utah State University. "Mandate Consultant"

(Parry, 1985) reviews the IEP (Individualized Educational Program) development procedures. As a planning tool, it can be used to help plan IEP development, ensuring that all legal requirements are met so that hearings to resolve parent-school system disputes are needed less frequently. "Behavior Consultant" (Ferrara, Serna, and Baer, 1986) is an expert system designed to recommend interventions for behavior-disordered students. Like CAPER, it can be used to plan individual student programs.

Potential Problems

A restriction on using expert systems for educational planning (and for other domains as well) is that good results will strongly depend on good data. For example, if a teacher who is using "Behavior Consultant" does not accurately describe the student's behavior, or if the collected data is incorrect, the interventions recommended by the system will probably be ineffective. Part of the expert knowledge of a human behavior consultant is in recognizing and questioning data that looks faulty. While it may be theoretically possible to emulate within an expert system the human ability to question data, that capability is not currently part of the system (or other similar systems). Likewise, it will be impossible for the CAPER system to help plan instructional interventions that will be effective if the data describing a student's current status is incomplete or inaccurate.

Decision Support

Examples

A second use for expert systems in education -- and the most common one in general -- is for decision support, or as a "second opinion" for decision making. Many medical expert systems, such as MYCIN (Davis, Buchanan and Shortliffe, 1975) have been developed for this purpose. Examples of educational expert systems that are designed for use in decision support are CAPER, CLASS.LD, and "Mandate Consultant", though some serve other purposes as well. One use of the CAPER expert system will be to offer recommendations for diagnostic procedures leading to appropriate instructional placements for students. Because of the expert knowledge embodied in the system, these recommendations will include only those tests and procedures that are valid for a student's age, language/cultural background, etc. These recommendations might add a new point of view to the deliberations of the instructional planning team, or may simply reinforce (or refute) their opinion. CAPER will also be helpful in a decision-support role for interpreting test data, since it is designed to yield technically valid interpretations of the test scores. In this capacity, CAPER would help to provide decision support that is not biased by race or ethnicity, is not forgetful of technical limitations of tests, and is not inaccurate in reporting data, as humans can sometimes be.

While CAPER is still in the development stage, so that its benefits can only be hypothesized, "Mandate Consultant" and CLASS.LD are completed systems that have been validated. Mandate Consultant can provide a reliable second opinion (Parry, 1986) in determining whether correct procedures have been followed in the development of a student's IEP. This information can be helpful to those in state and local agencies who are reviewing case histories, to officials preparing for hearings, or to parents who may question the correctness of educational procedures followed with their child's case. Likewise, CLASS.LD can provide a reliable second opinion regarding the appropriateness of a learning disabilities classification for a given student. Both of these expert systems have been subjected to extensive validation measures comparing their performance to that of human experts. Both systems have performed as well as the best of the experts, and better than many of them (Parry, 1986).

Potential Problems

Using expert systems as a "second opinion" is certainly less problematic than using them as a primary decision tool, but use in the second opinion capacity is still not without its problems. One problem is that it is not at all clear whose "expert" knowledge should be built into such a system; i.e., there is no consensus on who the experts are.

Who are the Experts? In education, expertise is divided among several sources including researchers, public officials, administrators and supervisors, and classroom teachers. While each of these sources of expertise can be important, they often present differing points of view on an issue. The result of considering all points could easily be unintelligible when the viewpoints do not come together neatly, or when they yield conflicting recommendations. In deciding whose expertise to build into an expert system, one should consider whose point of view would be most useful for the system's application.

For example, CLASS.LD (Hofmeister, 1984) uses knowledge derived from state and federal regulation to reach its decisions and recommendations. Similarly, "Mandate Consultant" (Parry, 1985) uses legal, regulatory information to review procedures for the development of IEPs. In these cases, clearly the best source of expertise to build into the knowledge base is the regulation itself, since that information is, by definition, the most authoritative source.

The answer to the question of whose expertise to include in the CAPER knowledge base, however, is much less clear. Who can provide the best expertise on the appropriate instructional program for a given student -- researchers, university consultants, school principals, school district specialists, or talented classroom teachers? While many disciplines have acknowledged authoritative sources for their expertise, the only consensus among educators is that practitioners, researchers, and policy makers know different things and need to share their expertise more. For this reason, the CAPER knowledge base is being designed to include information from specific sources for specific topics. Rather than combining sources of expertise for a single topic, the approach being used is to select one source of knowledge for each topic that can best be used in the decision-making process. Figure 1 indicates the source of information for the specified topics included in CAPER.

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insert Figure 1 about here

How much can you trust the experts? Another potential problem with using expert systems for decision support is deciding how much the recommendations of such a system can be trusted; i.e., how sure can the user be that the system's "reasoning" is correct? Two features of expert systems help with this dilemma. First, until its accuracy is tested, validated, scrutinized, and subjected to extensive evaluation, any system should be used only as a second opinion, and not as a primary decision-maker. Until both the technology for building expert systems and the specific system are more fully tested, expert systems should supplement, not replace, human decisions.

The second feature of expert systems addressing the issue of accurate reasoning is the requirement that an expert system's reasoning process be "traceable," allowing users to compare the inferences that the system makes with their own inferences. In this way, during a consultation, the intermediate results can always be checked. If there is error due to faulty data, the user can correct it. If faulty reasoning is detected, the knowledge-base author can make changes. The human user will always bear the the ultimate responsibility for intelligent decision making, for using the specific feature of the expert system efficiently, and for cautious use of expert systems in field applications.

Expert Systems for Training

A third educational use for expert systems is in training. Expert systems have potential as training tools in at least three ways. First, an expert system can recommend training for teachers. Second, they can teach information and processes to teacher trainees. Third, they can serve a training function simply by being used by novices who learn from the process of interacting with the expert knowledge embodied in the system. An example of each of these training roles will now be discussed.

Recommending training. SNAP (Smart Needs Assessment Program) is a large, complex expert system that recommends training experiences for regular education teachers who teach mainstreamed handicapped students. The goal in designing SNAP was to produce a system that would create individualized training programs for teachers that would take into account the amount of prior training they have had, their attitudes toward mainstreaming and teaching handicapped students, their own goals for professional training, their knowledge about effective teaching methods and procedures, and their overall skill in implementing instruction in the classroom. Each of these areas and the source of information for them are listed in Figure 2. SNAP uses information from each area to determine, for an individual teacher, a set of training needs. These needs are, in turn, used to select appropriate training options from an extensive database of modular training components. The components address a single training need or a group of needs. The selection of training options is also influenced by other factors such as cost, location, situational requirements (such as whether videotape equipment is required or whether access to the handicapped population is required for an observation), and other factors that would affect the appropriateness of a training option for a particular teacher's training needs.

The educational value of SNAP is its ability to train teachers in what they needs to know. The usual approach to training teachers for mainstreaming has been a "shotgun" approach a general course (perhaps "Introduction to Special Education" or "Introduction to Mainstreaming") covering numerous topics and providing very general information to a group of teachers presumed to be homogeneous in their training needs. Like homogeneous classroom instruction for youngsters, this approach is clearly lacking in its ability to meet individual needs. SNAP, then, has the potential of addressing this need by providing an individualized approach to training teachers for mainstreaming and -- if it is found effective -- to providing inservice training in other areas. The individual components of SNAP have already undergone field testing as they were being developed. The total system is currently undergoing extensive validation and evaluation, and the preliminary results look quite encouraging.

Teaching information and processes. Expert systems can also be designed specifically for teaching a specified group of individuals a body of information, skills, and/or processes. Expert systems which serve this pedagogical function have usually been preceded by the "second opinion" type of expert system, which was then modified for use as a training tool. MYCIN (Davis, Buchanan, and Shortliffe, 1975), for example, is a medical system for diagnosing bacterial diseases from the characteristics of bacterial cultures and patient symptoms. Subsequently, NEOMYCIN (Clancy and Letsinger, 1981) was developed as a modificatuib if the MYCIN system for teaching students to diagnose bacterial diseases. Several expert systems developed at

Utah State University have followed this two-step procedure of development from decision-support to training. For example, using CLASS.LD as the initial expert system, Ferrara and Prater (1985) modified the system to teach non-special education teachers to classify correctly students as learning disabled or not. Prater and Ferrara (1986) cite two approaches to the development of "training" expert systems. One approach is simply to teach the rules incorporated into the knowledge base so that novices will now have access to the same knowledge as the experts. The second is to use sample consultations of examples and non-examples to train teachers to make this discrimination in a conceptual learning approach. These approaches are being developed with "Mandate Consultant" and "Behavior Consultant" as well.

Novice use of expert procedures. Another way of using expert systems for training purposes is through the process of having novices run consultations with the system. By modelling the behavior of experts in seeking information, forming hypotheses and providing recommendations, the expert system is allows the novice user to deal with that expertise in a way that the novice can then emulate. Initial evaluation data from field tests of SNAP indicates that teachers believe they have learned a considerable amount of information about teacher effectiveness just by collecting and reporting the data requested by the expert system. With CAPER, it is also anticipated that by using the system's guidance through the referral, diagnosis, and planning processes for educationally at-risk students, decision-making team members will become more skilled in the process themselves.

Expert Systems as Research Tools

A fourth function for expert systems in education is for research. During the development of SNAP, the value of expert systems as a research tool emerged as an important contribution of the technology. As a research tool, expert system development can be used to examine the processes and information used by expert educators to solve particular problems. Second, in assembling the relevant knowledge and expertise needed to solve an educational problem, the system authors can discover instances of missing knowledge, inconsistent knowledge, and undocumented knowledge can be examined. Examples from the development of SNAP will help to explain these potential research benefits from the design of expert systems. In developing SNAP, it was first necessary to determine what kind of reasoning processes human experts in staff development would use to plan individualized inservice training programs for teachers. By examining these processes, we learned that the most common inference method used in expert systems -- production rules -- was inappropriate for a major part of the SNAP system. We determined that production rule reasoning (described elsewhere in this issue) would be appropriate for determining training needs, but not for selecting training options. It then became necessary to "try out" other inference mechanisms available in authoring tools. This process led to our consideration of abductive reasoning, minimal covering and irredundant covering, developed to model diagnostic reasoning in medicine (Reggia et al, 1985), for our problem. Engaging in this process of examining the appropriateness of inference methods has led to further research on the type of reasoning processes that are actually used by educators to make decisions, and the influence of that type of reasoning on decision making (Haynes and Lubell, 1986a; 1986b).

The second advantage that expert system technology can provide to educational research is to demonstrate to researchers and users the limitations of currently existing knowledge in an area of their discipline. For example, an important component of SNAP is the production rule knowledge base that is used for evaluating observational data to determine an individual teacher's skill in the classroom. The large body of research on teacher effectiveness which was used to create the knowledge base was analyzed systematically and the results were then formed into production rules. By engaging in this process, we found some important limitations to this research including:

o lack of research dealing with students and classrooms at certain grade levels;

o over-generalized conclusions reached from significant but weak correlations;

o lack of rigorous outcome measures on many studies measuring non-achievement outcomes;

o over-reliance on highly inferential procedures for measuring factors such as students' engaged time;

o unjustified substitution of Academic Learning Time for achievement in studies interpreted as measuring achievement as an outcome measure; and o many unresolved contradictions in findings regarding the relative merits of direct instruction vs. other instructional methods.

As a research tool, then, expert systems can be extremely helpful in guiding researchers to formalize and organize a large body of knowledge, and in understanding the reasoning processes used by experts to make educational decisons.

Cautions to Would-be Expert System Builders and Users

The experiences in building educational expert sytems so far have been promising, but a few limits to this enthusiasm are in order.

1. Currently, expert system tools rely heavily on production rules and deductive inference. While considerable portions of educational expertise may be accurately represented in this format, we have found that much of it is not. It would therefore be extremely important that knowledge base authors recognize the influence of a given reasoning process on the outcome of an educational decision, and that either they select tools that can model that process or limit their applications to those areas that can accurately be represented by existing expert system authoring tools.

2. The expertise built into expert systems should reflect the best source of knowledge on a topic, and not simply the most easily obtained source of knowledge. Where multiple sources are available, they should all be evaluated and used appropriately.

3. Where expert systems are used for training, thorough

evaluation of the system should take place *prior to* adaptation for training purposes so that trainees learn expert information and procedures, rather than novice-level skills.

4. Expert system technology in education is new. Its potential is great, but its performance record is not yet established. Until a successful record is established, expert systems use should be limited to decision support, or second-opinion status.

References

Clancy, W.J. & Letsinger, R. (1981). NEOMYCIN: Reconfiguring a rule-based expert system for application to teaching. *Proceedings of the seventh international joint conference on artificial intelligence*. Vancouver, B.C., Canada: University of British Columbia.

Davis, R., Buchanan, B. & Shortliffe, E. (1975). *Production rules as a representation for a knowledge-base consultant program*. Report STAN-CS-75-519 MEMO AIM-226). Palo Alto, CA: Stanford University.

Ferrara, J.M., Serna, R.W., & Baer, R.D. (1986). *Behavior Consultant: An expert system for the diagnosis of social/emotional behavioral problems*. [Computer Program]. Logan, UT: Utah State University.

Haynes, J.A. & Lubell, J. (1986a). Abductive and deductive inference in an expert system for needs assessment in teacher training for special education. *Paper presented at the Association for Behavior Analysis*, Milwaukee, WI.

Haynes, J.A. & Lubell, J. (1986b). Artificial intelligence and inference methods to plan for teacher training programs. *Technical Report #202*, College Park, MD: University of Maryland, Institute for the Study of Exceptional Children and Youth.

Hofmeister, A.M. (1984). *CLAS-LD: An expert system for classifying learning disabilities*, [Computer Program]. Logan, UT: Utah State University.

Parry, J.D. (1986). The development and validation of an expert system for reviewing a special education practice. *Paper presented at the Association for Behavior Analysis*, Milwaukee, WI.

Prater, M. & Ferrara, J.M. (1986). Training applications of expert systems. *Paper presented at the Association for Behavior Analysis*, Milwaukee, WI.

Reggia, J.A., Nau, D.S. and Wang, P.Y. (1983). A theory of abductive inference in diatnostic expert systems. *Technical Report TR-1338*, University of Maryland, Department of Computer Science.

Waterman, D.A. (1986). A Guide to Expert Systems. Reading, MA: Addison-Wesley Publishing Company.

Figure 1

Sources of Expertise in CAPER

TOPIC	SOURCE
Effective interventions for a given student problem	Research literature
Feasibility of interventions	Naturalistic research
Availability of instructional options	Naturalistic research District personnel
Student data	Teacher input
Required procedures for assessment	District policy
Formal tests for obtaining specified data	Research literature State and local policy
Valid interpretations for formal test data	Technical manual for tests
Informal diagnostic procedures	Informal consultants' recommendations
Interpretation of informal diagnosis	Informal consultants' recommendations

Figure 2

Information Sources For SNAP

Teacher Characteristic	Computer Program	Description
Attitude toward mainstreaming and teaching handicapped students.	SOC	A modification of the Stages of Concern to deal specifically with mainstreaming.
Goals for training	GOALS	Teachers select a set of goals for their training.
Classroom effectiveness including		
Direct Instruction Ratio	DIRprob	Teachers collect self-observation data and the program evaluates their ratio of direct instruction.
Questioning skills	Quesprob	Teachers analyze their patterns of questioning and the program evaluates its effectiveness.
Academic learning time	ALTprob	Teachers collect self-observation data and the program evaluates the amount of academic learning time available in the classroom.
Experience, training, age, etc.	PERSDATA	A collection of demographic information.

Appendix O

SNAP Course Evaluation: Content Analysis of Written Comments

SNAP COURSE EVALUATION: CONTENT ANALYSIS OF WRITTEN COMMENTS

Shari Castle
August 20, 1986

Question 1: Was it a successful learning experience?

Yes = 18 No = 0

Why?
--tropts: the book, variety, practicality, usefulness, direct application, new ideas (15 = 83%)
--sharing between participants: (7 = 39%)
--presentation: excellent, problem-solving approach, clear expectations stated, efficiently introduced (4 = 22%)
--feelings and attitudes: unique, fascinating, insights, dignity, opportunity to influence others (3 = 17%)
--confidence in teaching mainstreamed students: (2 = 11%)
--focus on individual needs and interests: (1 = 6%)
--instructor: enthusiastic, knowledgeable (1 = 6%)

Why not?
--computer not helpful (1 = 6%)

Question 2: Make one statement about the course.

--attitudes and feelings: excitement, renewal, relaxation, enjoyment, interesting, confidence, useful (7 = 39%)
--learned alot: (5 = 28%)
--new appreciation for mainstreaming: (3 = 17%)
--effective presentation: (3 = 17%)
--tropts: (1 = 6%)
--more time: (1 = 6%)
--observations of little value: (1 = 6%)
--left blank: (1 = 6%)

Question 3: What changes would you like to see?

--more: films, discussion, videos, presentations, copies of tropts, accessibility of tropts, use of blue book, non-recommended tropts (8 = 44%)
--more time: (6 = 33%)
--Less: writing, fewer tropts, discussion (4 = 22%)
--function of computer?: (4 = 22%)
--change classroom self-observation: too time-consuming, little help (3 = 17%)
--add a general text on mainstreaming: (1 = 6%)
--combine "David" and George Will into one tropt: (1 = 6%)
--satisfy special ed recertification requirement: (1 = 6%)
--nothing: (1 = 6%)

Question 4: What are the strengths of the course?

--tropts: variety, quality, accessibility, targetted information, applicable across grades and subjects, up-to-date (11 = 61%)
--sharing with participants: (11 = 61%)
--instructor: personality, energy, knowledge, vitality, flexibility, support, facilitation skill (8 = 44%)
--focus on individual needs and design of own learning: (6 = 33%)
--atmosphere: open, relaxed, low-pressure, casual, low memorization, supportive (4 = 22%)
--presentations: (1 = 6%)

SUMMARY

The course was perceived by the participants as highly successful. Positive comments outnumbered negative comments by 5 to 1. The negative comments that were made suggested improvements rather than expressing dissatifaction with the course. Participants believed they had learned much that would positively influence their teaching.

Strengths of the course as metnioned by the participants, from high to low frequency include:
--the training options were perceived as the strongest aspect of the course;
--the sharing that occurred between participants was highly valued;
--the positive feelings and attitudes generated by the course were deemed important;
--the effectiveness and enthusiasm of the instructor contributed significantly to the feelings, attitudes, and learnings of the participants;
--the structure and environment of the course (addressing individual needs, time for sharing and discussion, clear expectations, involvement in designing own learning, supportive atmosphere) also contributed to the participants learning and enthusiasm for the course;
--the course increased the participant's awareness of the needs of mainstreamed students and their own abilities to integrate and teach those students effectively.

In sum, the tropts, the structure and atmosphere of the course, and the effectiveness and enthusiam of the instructor all contributed to a most successful learning experience for the participants.

The weaknesses of the course as mentioned by the participants, from high to low frequency include:
--the limited accessibility of the tropts made it difficult to locate those that were needed; some participants wanted more use of the blue book for selecting their own tropts and more time for non-recommended tropts; others wanted fewer tropts to be studied and used in greater depth;
--the majority of participants requested more time;

--the role and importance of the computer and of the classroom observations were questioned by about one-quarter of the participants.

In sum, difficulty in obtaining and choosing tropts was troublesome. The situation might be eased by providing multiple copies of tropts and providing additional time for pursuing interests in non-recommended tropts, realizing that this will not lend itself to in depth treatment of a given tropt.

Time was limited; perhaps the course could be extended over a greater period of time (i.e., a semester) with more time to read and try out tropts, more time for presentations by participants, and more time for depth of study.

The process that preceded the course itself--involving the computer and the classroom observations--was unclear to the participants. The importance of the classroom observations and the role of the computer need to be clarified for the participants.